PRELIMINARY RESULTS OF RECREATIONAL USE ATTAINABILITY ANALYSES OF THE DOUBLE MOUTAIN FORK BRAZOS RIVER (1241) AND SABANA RIVER (1222C)

BY

Dr. John Baker

Dr. Kirk Winemiller

Texas AgriLife Research|Extension

Texas A & M University System

College Station, Texas

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Table of Contents

List of Tables

Page

Page

Page

List of Figures

Page

Page

Page

Page

List of Appendices

Page

Summary

Double Mountain Fork Brazos River

The Double Mountain Fork Brazos River, classified water body 1241, is a 148.8-mile stream that was evaluated with 69 first surveys, 16 second surveys and 56 recreational use interviews. The stream flows from the confluence of the North Fork Double Mountain Fork Brazos River in Kent County to the confluence with the Salt Fork Brazos River in Stonewall County (Figure 6).

The watershed of the Double Mountain Fork Brazos River covers 1,666,377 acres and extends from the town of Whiteface in Cochran County to the confluence with the Salt Fork Brazos River 9 miles northwest of Rule in Haskell County (Figure 7). The stream flows through a very sparsely populated rural area (Figure 9) that is dominated by shrubland, grassland and row crops (Figure 11) in the eastern portion of the watershed. Eighty-nine percent of the riparian zone of the Double Mountain Fork Brazos River, was, in fact, recorded as a shrub dominated corridor by field technicians. The riparian corridor also consisted of cliffs (10%), forests (1%) and steep banks (1%).

Thirty-seven interviews were collected relating to primary contact recreation on the Double Mountain Fork Brazos River. Nineteen interviews described primary contact at the State Highway (S.H.) 70 bridge crossing compared to 3 interviews for U.S. Highway 83, 1 interview for S.H. 208 and 2 interviews for U.S. Highway 380. Twenty-five interviews described primary contact in the 2010s, 4 in the 2000s, 4 in the 1990s, 7 in the 1980s and 5 in the 1970s. Based on interviews, S.H. 70 and U.S. Highway 83 were found to be important areas for primary contact recreation.

Most measurements during field surveys on the Double Mountain Fork Brazos River were collected during a summer time period that had a very moist Palmer drought index. Six substantial pools were found on the 69 survey sites surveyed (69 first surveys and 16 second surveys included). The river had an average thalweg of 0.30 m for the first and second surveys and an average width of 9.95 and 8.13 m, respectively. The stream type was categorized as

perennial (87 %) and intermittent with perennial pools (13 %) for the first surveys and 100 % perennial for the second surveys. For the first surveys, the flow was characterized as normal (99 %) and high (1 %). For all second surveys, the flow was characterized as normal. The river was wadeable during all surveys and never had a thalweg greater than 1.5 m. No wastewater outfalls or impoundments were found on the Double Mountain Fork Brazos River.

Based on 56 recreational use interviews, sixty-three percent of the people that participated in the interviews and their families use the Double Mountain Fork Brazos River for recreation. Among the 35 interviewees that use the stream for recreation, 86 % engage in primary contact recreational activities including swimming (25 interviews), wading children (11 interviews) and tubing (6 interviews) (Table 10). Fourteen percent engaged in secondary contact recreational activities including wading adults (5 interviews), fishing (14 interviews), boating (1 interview) and kayaking (3 interviews). Interviewees have witnessed primary contact recreational activities including swimming (12 interviews), tubing (4 interviews) and wading children (2 interviews) and secondary contact recreation including fishing, kayaking and wading adults.

Interviewees characterized the dominant stream type as perennial (29 %), intermittent with perennial pools (56 %) and intermittent (10 %). Most of the 17 interviewees that do not use the stream state that the stream has little or no water (47 %). Other reasons given for not using the stream for recreation were related to other personal interests (41 %), poor access (18 %), too little water or dangerously fast water (6 %) or does not own property on the stream (6 %).

No primary contact recreational activities were observed on the Double Mountain Fork Brazos River during the field surveys. A secondary contact activity was observed when one person was found on the shore with their feet touching the water at survey site 1241.82. No indications of human use related to primary contact were found on the stream. Indications of human use found related to secondary contact included fishing tackle (9 survey sites, Figures 16B-D) and boating (2 survey sites, Figure 16B). Twenty-three indications of human use related to non-contact activities were found, including: an ATV trail, beverage cans and bottles, bullet casings, burnt wood (Figure 16F), children's footwear, clothing, decorative lights on the bank, a deer feeder, a fire pit, a fishing platform, a folding chair (Figure 16E), foot paths/prints (Figure 16A), graffiti, hunted turtles (Figure 16H), hunting blinds, an old lawn chair, roads, shooting targets, shotgun

shells (Figure 16G), a tent tie down, tire ruts and a trail camera. General public access to the Double Mountain Fork Brazos River was estimated to be moderate.

Sabana River

The Sabana River, unclassified water body 1222C, is a 74.6-mile-long stream that was evaluated with 41 field surveys (Figures 27) and 92 recreational use interviews. It flows from the upstream portion of the stream northwest of Rising Star in Eastland County to the confluence of Proctor Lake northeast of Comanche County. Forest was the most frequently recorded riparian zone on the Sabana River (71 %) followed by steep banks (12 %), a shrub dominated corridor (7 %), pastures (5 %) and denuded/eroded banks (5 %).

All measurements during field surveys on the Sabana River were collected during a summer time period that had an extremely moist Palmer drought index. Thirty substantial pools were found at twenty survey sites along the Sabana River. Five out of 41 surveys sites (12 %) were completely non-wadeable. Seven wadeable surveys sites had portions of the reach that were not wadeable due to deep water. The average measured thalweg and stream width was 0.48 m and 5.49 m, respectively. The stream type was categorized as perennial (17 %), intermittent with perennial pools (34 %), intermittent (10 %) and ephemeral (39 %). The flow was characterized as high (29 %), normal (22 %), low (5 %), no flow (34 %) and dry (10 %). Based on the TCEQ Wastewater Outfall shapefile, no wastewater outfalls were found on the Sabana River. One impoundment was found on the stream near the beginning of the segment.

Based on 92 recreational use interviews, forty-two percent of the people that participated in the interviews and their families use the Sabana River for recreation. Among the 38 interviewees that use the stream for recreation, 47 % engage in primary contact recreational activities including swimming (7 interviews), wading children (7 interviews) and tubing (3 interviews) (Table 22). Secondary contact recreation activities include wading adults (1 interview), fishing (25 interviews), boating (1 interview) and canoeing (1 interview). Interviewees have witnessed primary contact recreation activities including swimming (5 interviews), wading children (3

interviews) and one Baptism. Secondary contact recreation witnessed include fishing (27 interviews), kayaking (1 interview), boating (2 interviews) and wading adults (2 interviews).

Interviewees characterized the dominant stream type as intermittent with perennial pools (38 %), intermittent (22 %), ephemeral (21 %), perennial (8 %) and dry (1 %). Most of the 52 interviewees that do not use the stream state that the stream has little or no water (33 %). Other reasons given for not using the stream for recreation were related to other better recreational opportunities (10 %), other personal interests (8 %), poor water quality (4 %) and poor access (4 %).

No primary or secondary contact recreation activities were observed on the Sabana River during the field surveys. Indications of human use related to secondary contact recreation included fishing tackle found at 3 survey sites (Table 16). Indications of human use related to non-contact activities found included ATV trails, bicycle tracks, bullet casings, a chair and a radio, children's toys, deer feeders and stands, fireworks, foot paths/prints, graffiti, a picnic table, shooting targets, shotgun shells and toilet paper.

Introduction

Section 101(a)(2) of the Federal Water Pollution Control Amendments of 1972 or the Clean Water Act (the Act) states it is the national goal, wherever attainable, to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the waters of the United States. Under section 131.10(j) of the Water Quality Standards Regulation of the United States Environmental Protection Agency (EPA), states are required to conduct a use attainability analysis (UAA) whenever the state designates uses of water bodies that do not include the uses specified in section 101(a)(2) of the Act, removes one of these designated uses, or adopts subcategories of these uses that require less stringent criteria.

A UAA (or RUAA) is a structured scientific assessment of the factors affecting the attainment of a use on a water body. The overall purpose of a RUAA is to make sure streams have the correct recreational use classification following the guidelines established in the Act. The ultimate goal is that the new designated use classification is more accurate.

RUAAs may include physical, chemical and biological evaluations to determine what factors impair attainment of designated uses and provide information to determine what uses are appropriate and feasible for the water body in question. Important factors in such analyses can include naturally occurring pollutant concentrations, anthropogenic sources of pollution, water depth, hydrological modifications and natural physical characteristics of streams that could impair the use. In addition, RUAAs typically assess the current uses (recreation and otherwise) of the water bodies under evaluation.

States use the information collected in a RUAA to demonstrate to the EPA that attaining the uses in section 101(a)(2) are not feasible because:

1. naturally occurring pollutant concentrations prevent the attainment of the use;
2. natural, ephemeral, intermittent or low- flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met;

3. human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. hydrologic modifications preclude the attainment of the use and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;
5. physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to [chemical] water quality, preclude attainment of aquatic life protection uses; or
6. controls more stringent than those required by sections 30l(b)(l)(A) and (B) and 306 of the Act would result in substantial and widespread economic and social impact.

On June 10 through August 13, 2016, a team from Texas AgriLife Research, Texas A&M University System (TAMU), carried out Recreational Use Attainability Analyses on the Double Mountain Fork Brazos River (1241) and the Sabana River (1222C). Following the methodology in TCEQ's 2014 Recreational Use Attainability Analysis Procedures, team members talked with landowners on these streams, interviewed recreational users and conducted field surveys along the Double Mountain Fork Brazos River and the Sabana River. The Water Quality Standards Group within the TCEQ will use this information to determine if these water bodies have the appropriate recreation use and criterion.

Methods

Creation of a GIS Project

An ESRI ArcMap GIS project was created to acquire the information needed to carry out the RUAAs. A stream shapefile was obtained from the TCEQ. Shapefiles of Texas counties, cities, major roads and stream point sources (TCEQ Wastewater Outfalls) were obtained from (TCEQ's Atlas of Texas Surface Waters). A watershed shapefile (basinspy) was obtained from Texas Parks and Wildlife. Aerial photographs (NAIP14/15 nc-cir 1m) and street shapefiles were obtained from the Texas Natural Resources Information System. Shapefiles (polygons) of private property parcels were obtained from county property appraisal district offices. Shapefiles of public recreation areas were obtained from the Texas Parks and Wildlife Department (TPWD) and Texas General Land Office (TGLO). These included TPWD parks (parkpy.shp and tpwdparks.shp), state preserves (preserves.shp), sanctuaries managed by the Audubon Society (sanctuaries.shp) and wildlife refuges managed by the U.S. Fish and Wildlife Service (wildliferefuges.shp).

Photograph Naming Convention

In sequence, photograph names (i.e. 1.11_Dwn150_1241.23_07182016_124159) provide the camera number, a period, a photo number assigned by the camera, an underscore, a code which describes the contents of the photograph, the location in meters along the stream reach where the photograph was taken, an underscore, the segment identification code for the specific survey site, an underscore, the date, an underscore and the time of day to the nearest second in military time. Photographs taken at locations other than 0, 150 or 300 meters along the reach do not have reach location (distance along the reach) information. The example photograph name above was taken by camera 1, was the 11th photograph assigned by the camera, was depicting a downstream photograph of the stream 150 meters along the reach at survey site 1241.23 (Survey site 23 on the Double Mountain Fork Brazos River (1241)). This example photograph was taken on July 18, 2016 at 12:41 and 59 seconds. Content codes include Up (upstream), Dwn (downstream), LB (left bank), RB (right bank), HP (human presence), IHU (indications of human use), IPC

(indication of primary contact recreation), SC (surrounding conditions), SPA (site/public access), PR (promote recreation), PP (public park), IR (impede recreation), G (garbage or debris), UC (unsafe condition), CO (channel obstructions), FPS (flowing point source or NPDES discharge), HM (hydrologic modifications), Dam (dam or on channel impoundment), W (wildlife or animal evidence (not related to sustained aquatic habitat)) and SAH (sustained aquatic habitat).

Sampling Design and Site Selection

Systematic and purposive sampling methods were used to select survey sites on the Double Mountain Fork Brazos and Sabana Rivers. Using TCEQ's stream shapefile, survey sites were generally evenly spaced every 1.67 miles or 3 points per 5-mile segment on each stream. This methodology ensured that the survey sites provide a representative sample of the conditions that exist along the entire population of the stream. In order to ensure that recreational use was targeted for measurement, evenly spaced points were replaced with sites near these points where recreation was most likely to occur. These targeted areas of recreational use included bridges and other areas that are accessible to recreational users. Every effort was made to survey all sites. Some survey sites however, were not sampled due to the lack of permission from private property owners.

Collected Data for Each Stream Survey Site

Field data was collected based on TCEQ's 2014 Recreational Use Attainability Analyses Procedures for a Comprehensive RUAA Survey (Double Mountain Fork Brazos River) and a Basic RUAA Survey (Sabana River). Following these procedures, the Contact Information Form (Appendix 2), the RUAA Summary (Appendix 5), Field Data Sheets (Appendix 3) and RUAA Interview Forms (Appendix 4) were completed for each RUAA stream survey site. Monthly Palmer Drought Index data was obtained NOAA's National Climatic Data Center's Climate Monitoring (Historical Palmer Drought Indices). Daily precipitation data was obtained from (NOAA's National Climatic Data Center). Averaged daily precipitation data was used to produce preceding 30 day, 7 day and 1 day precipitation summary statistics.

Statistical Analyses

Basic statistical analyses were used to summarize collected RUAA data. Quantitative data such as average thalweg and average precipitation were determined by calculating the mean. Categorical data was summarized by counting the number of occurrences or calculating the proportion of occurrences out of the total number recorded.

Completion of the RUAA Summary

The average thalweg for both streams was determined by calculating the mean thalweg for each survey site and then the mean of these means. Microsoft Autofilter was used to sort the data and determine if either stream had substantial pools deeper than 1 m. Observations on use and the general level of public access were determined by using multiple sources of information. Observations on use including primary contact, secondary contact and noncontact recreation activities were primarily determined by considering information provided by interviews with land owners and residents surrounding the stream. The second factor considered came from the information recorded by field surveys and the last factor considered were field observations of indications of human use at survey sites. The general level of public access was determined primarily by the survey team's responses to "Describe Access Opportunities" for each survey site and secondarily on "Bank Access", "Surrounding Conditions that Impede Recreation" and the number of recreation areas located on each stream.

Double Mountain Fork Brazos River Results

The Double Mountain Fork Brazos River (1241) (Figures 1-5) is a 148.8-mile-long classified stream segment that flows from the confluence of the North Fork Double Mountain Fork Brazos River in Kent County to the confluence with the Salt Fork Brazos River in Stonewall County. Recreation and physical characteristics of the Double Mountain Fork Brazos River were characterized with 85 field surveys (69 first surveys and 16 second surveys) (Figure 6) and 56 recreational use interviews.

Figure 1. Photograph of the Double Mountain Fork Brazos River (Water body 1241) at RUAA survey site 1241.1 on July 31, 2016.

Figure 2. Photograph of the Double Mountain Fork Brazos River (Water body 1241) at RUAA survey site 1241.22 on July 30, 2016.

Figure 3. Photograph of the Double Mountain Fork Brazos River (Water body 1241) at RUAA survey site 1241.55 on July 30, 2016.

Figure 4. Photograph of the Double Mountain Fork Brazos River (Water body 1241) at RUAA survey site 1241.76 on July 10, 2016.

Figure 5. Photograph of the Double Mountain Fork Brazos River (Water body 1241) at RUAA survey site 1241.89 on August 12, 2016.

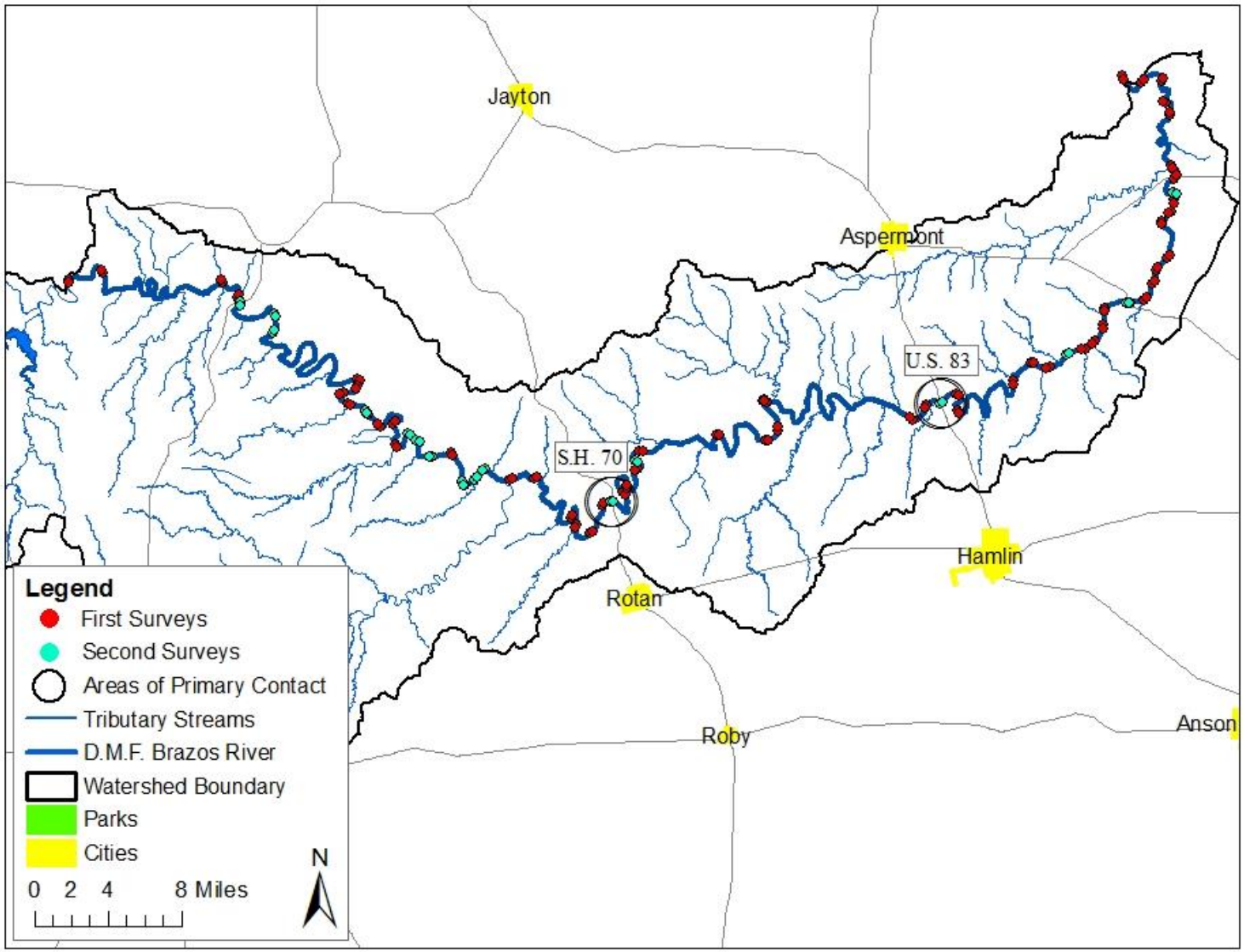

Figure 6. Map of the Double Mountain Fork Brazos River with completed survey sites, the primary contact areas of the State Highway 70 and U.S. Highway 83 bridge crossings, tributary streams, parks, cities and major roads.

Watershed Characteristics

The watershed of the Double Mountain Fork Brazos River (1241) covers 1,666,377 acres and extends from the town of Whiteface in Cochran County to the confluence with the Salt Fork Brazos River 9 miles northwest of Rule in Haskell County. The river is located in the eastern portion of the watershed largely in Kent, Stonewall and Haskell Counties. Nearby cities around the river include Rotan, Hamlin, Aspermont and Rule. Tributaries of the Double Mountain Fork Brazos River (1241) include the South Fork Double Mountain Fork Brazos River (1241D) (by way of Lake Alan Henry), the North Fork Double Mountain Fork Brazos River (1241A), Rough Creek, Salt Creek, Gyp Creek and Tonk Creek.

The watershed covers parts of 14 counties. Seven cities are located within the watershed. Based on 2010 US Census (U.S. Census Bureau's Factfinder Website for city population data), Levelland has the largest population of 13,542 followed by Tahoka (2,673), Aspermont (919), Wilson (489),Whiteface (449), Ropesville (434) and New Home (334) (Figure 7). The entire watershed and the portion of the watershed surrounding the Double Mountain Fork Brazos River is rural, typically with populations of 0-10 people per US Census block based on the US Census Bureau Decennial Census Program's 2010 Summary File 1 data (U.S. Census Bureau's Factfinder Website for downloading data) (Figures 8 and 9).

The ecoregions surrounding the river in Kent, Stonewall and Haskell Counties consist of Southwestern Tablelands comprised a mosaic of Flat Tablelands and Valleys (26b) and Caprock Canyons, Badlands and Breaks (26c) (Griffith et al., 2007). Flat Tablelands and Valleys are relatively flat landscapes with fine sandy loams and silt loams soils that are generally used to grow cotton, sorghum, corn and wheat. Flat Tablelands and Valleys also support grazing livestock and petroleum and gas extraction. Riparian vegetation includes cottonwood, elm, native shrubs and introduced salt cedars (Griffith et al., 2007). Caprock Canyons, Badlands and Breaks are a highly diverse terrain characterized by cliffs, badlands and canyons with intermittent and spring fed streams that form the Brazos River. The streams of the Caprock Canyons, Badlands and Breaks generally have high sediment loads and salt concentrations due to the erosion of badlands and dissolution of gypsum and salt deposits that are remnants of a shallow Permian sea. Riparian vegetation includes cottonwood, elm, willow, hackberry and salt

cedars. Caprock Canyons, Badlands and Breaks are generally used for grazing livestock and oil extraction (Griffith et al., 2007).

The land use and cover of the watershed largely consists of row crops, shrubland and grassland. The western portion of the watershed is dominated by row crops (Figure 10). The eastern portion of the watershed surrounding the stream in Kent, Stonewall and Haskell Counties is dominated by shrubland, grassland and to a lesser extent row crops (Figure 11) (USGS, 20141010). Kent County consists of 577,920 acres of which, 563,124 acres (97.4 %) are located on farms. This farm land consists of pastureland (92.1 %) and cropland (7.0 %). Livestock numbers include cattle and calves (11,865), horses and ponies (512), layers (130), sheep and lambs (78) and mules, burros and donkeys (20). Cropland in acres consists of upland cotton (2,684), forage-land used for hay, grass silage and greenchop (2,126) and wheat (850) (USDA, 2012). Stonewall County consists of 588,800 acres of which, 80.3 % are located on farms. Farm land consists of pastureland (76.7 %) and cropland (16.8 %). Livestock numbers included cattle and calves (17,152), horses and ponies (432) and layers (429). Cropland in acres consists of wheat (7,756), upland cotton (5,005) and forage-land used for hay, grass silage and greenchop (2,334) (USDA, 2012). Haskell County consists of 582,400 acres of which, 97.4 % are located on farms. Farm land consists of cropland (52.6 %) and pastureland (45.6 %). Livestock numbers include cattle and calves (16,119), horses and ponies (571), layers (262) and goats (221). Cropland in acres consists of winter wheat (95,996), upland cotton (23,873) and sorghum for grain (11,289) (USDA, 2012).

Temperatures in Aspermont, Texas in the vicinity of the stream from 1975 to 2017 range from a mean monthly minimum of 28.6 degrees Fahrenheit in January to a mean monthly maximum of 96.9 degrees Fahrenheit in July (Station I.D. Aspermont 410394 (Coop), xmacis.rcc-acis.org (NOAA Regional Climate Center)). The mean annual precipitation was 22.38 inches. The mean monthly total precipitation from 2000 to 2016 for May, June, July and August was 3.21, 3.15, 1.96 and 2.59 inches, respectively. Prominent summer droughts occurred in 2006 and 2011 (Figure 12). The mean monthly stream gauge height from 2000 to 2016 for May, June, July and August was 2.77, 2.70, 2.83 and 2.48 feet, respectively (Station I.D. USGS 08080500, https://waterdata.usgs.gov). Based on gauge height data, a significant drought occurred in 2011 (Figure 12).

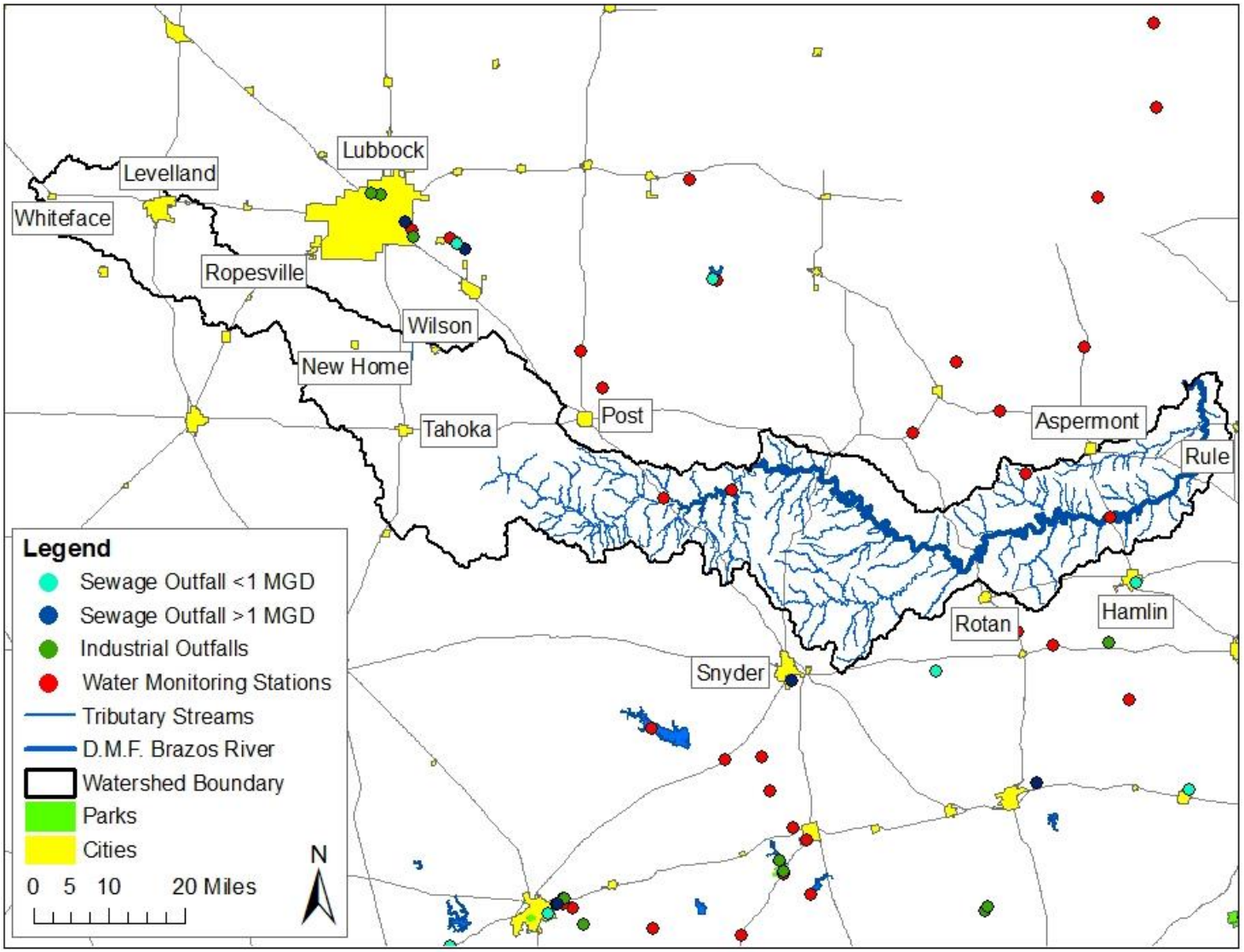

Figure 7. Map of the Double Mountain Fork Brazos River with wastewater outfalls, TCEQ water quality monitoring stations, tributary streams, parks, cities and major roads.

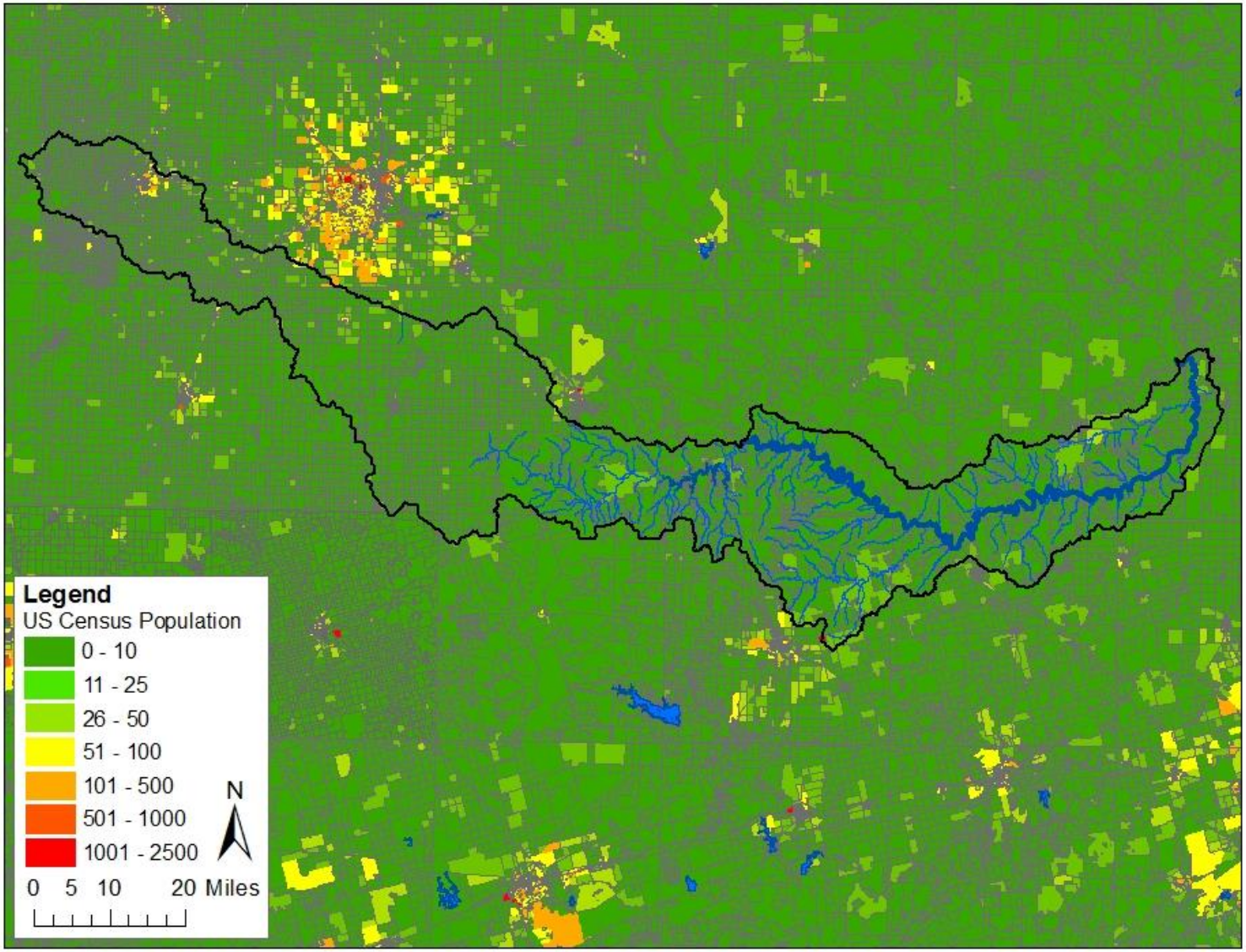

Figure 8. Map of the population in U.S. Census blocks in the Double Mountain Fork Brazos River watershed. Population data was obtained from the U.S. Census Bureau's 2010 Decennial Census.

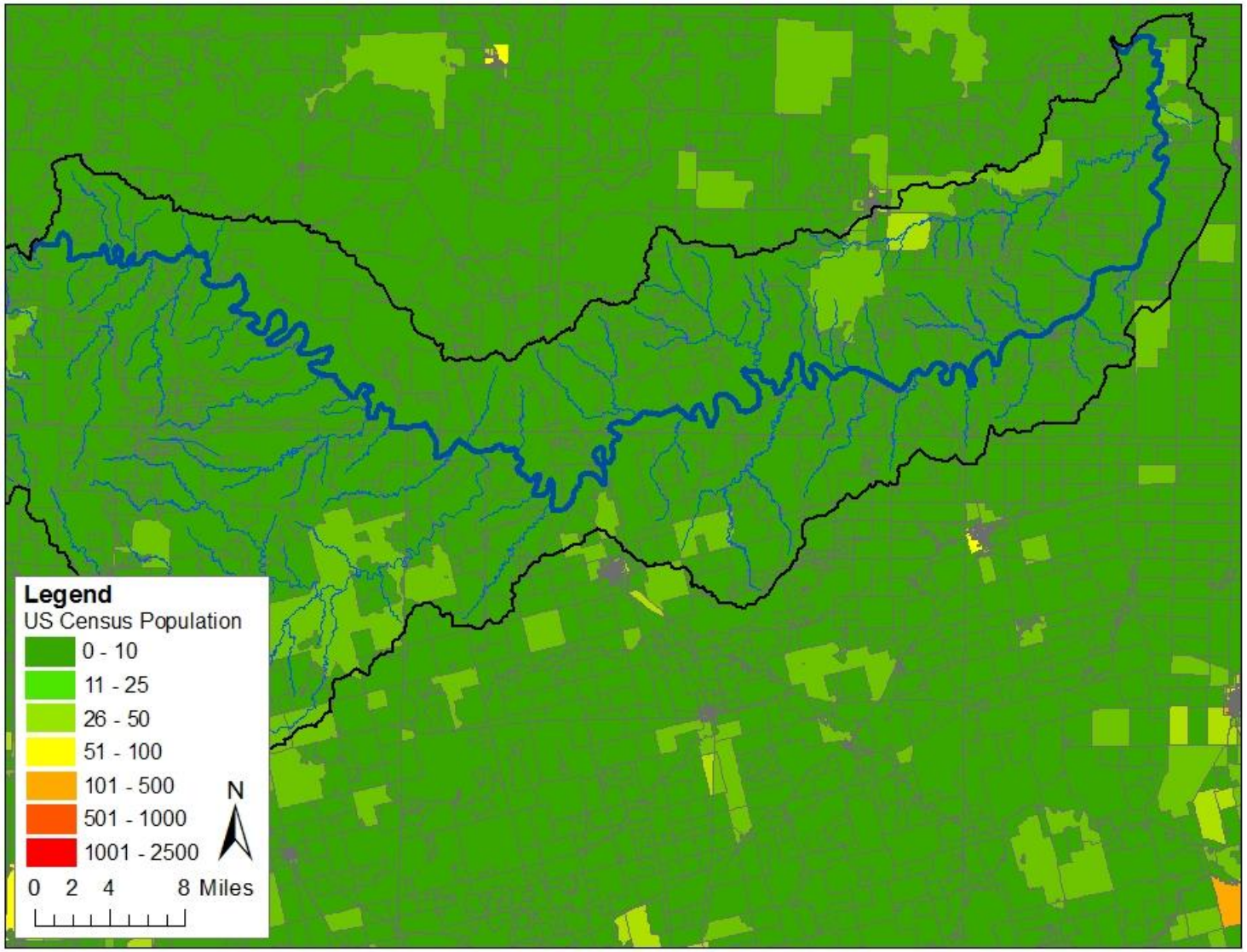

Figure 9. Map of the population in U.S. Census blocks around the Double Mountain Fork Brazos River. Population data was obtained from the U.S. Census Bureau's 2010 Decennial Census.

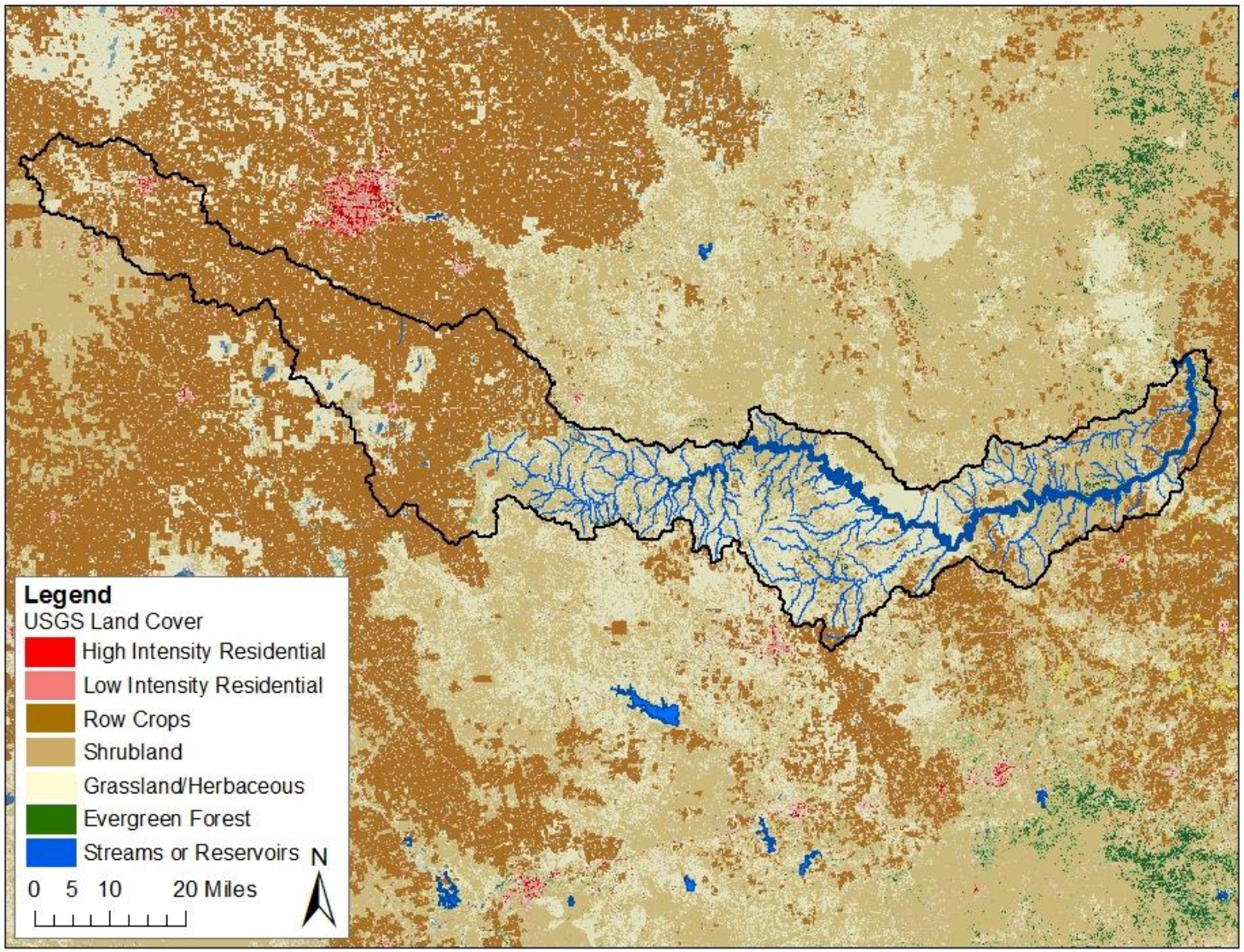

Figure 10. Map of the land use and cover in the Double Mountain Fork Brazos River watershed. Data was obtained from the USGS National Land Cover Database (2011 edition, amended 2014).

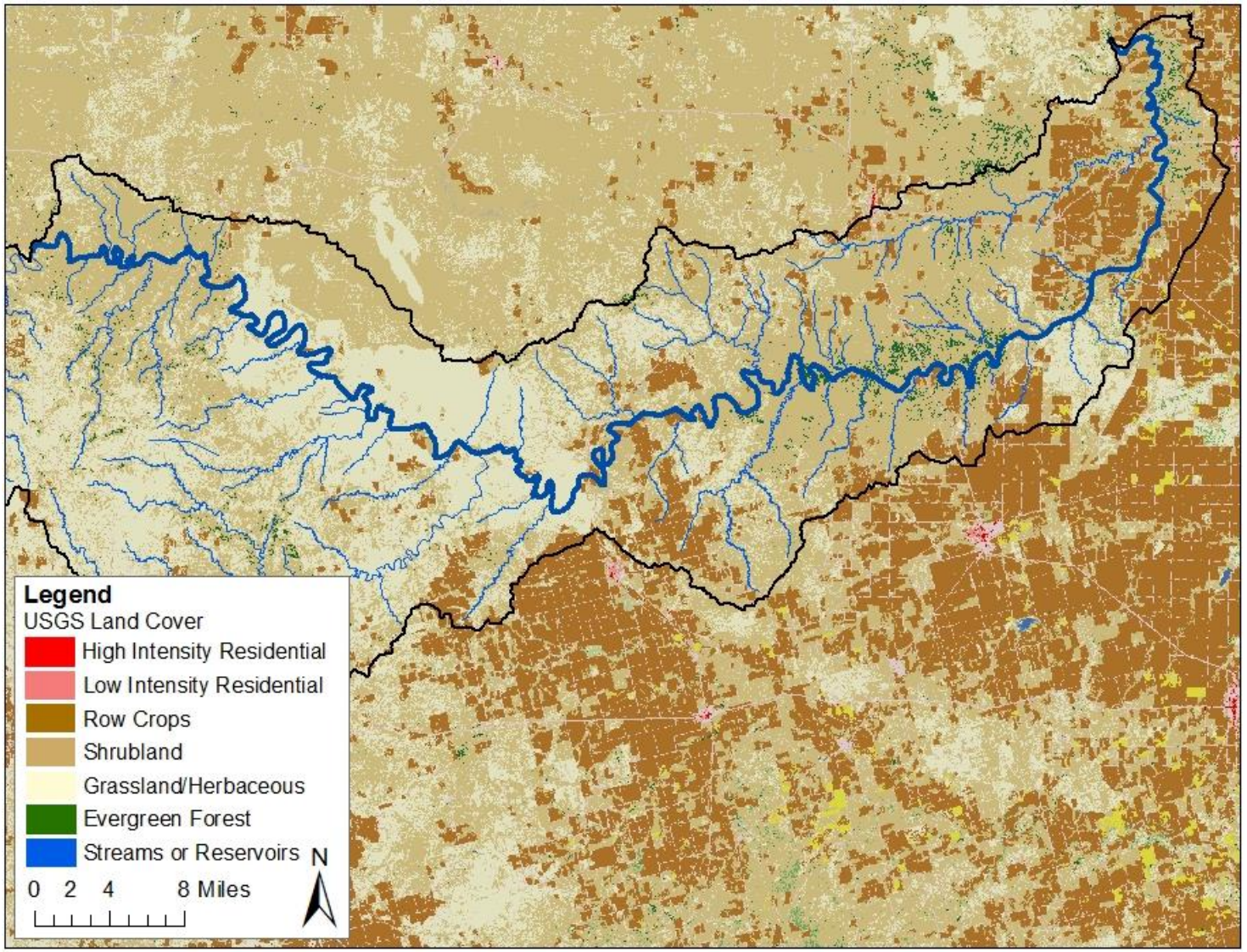

Figure 11. Map of the land use and cover around the Double Mountain Fork Brazos River. Data was obtained from the USGS National Land Cover Database (2011 edition, amended 2014).

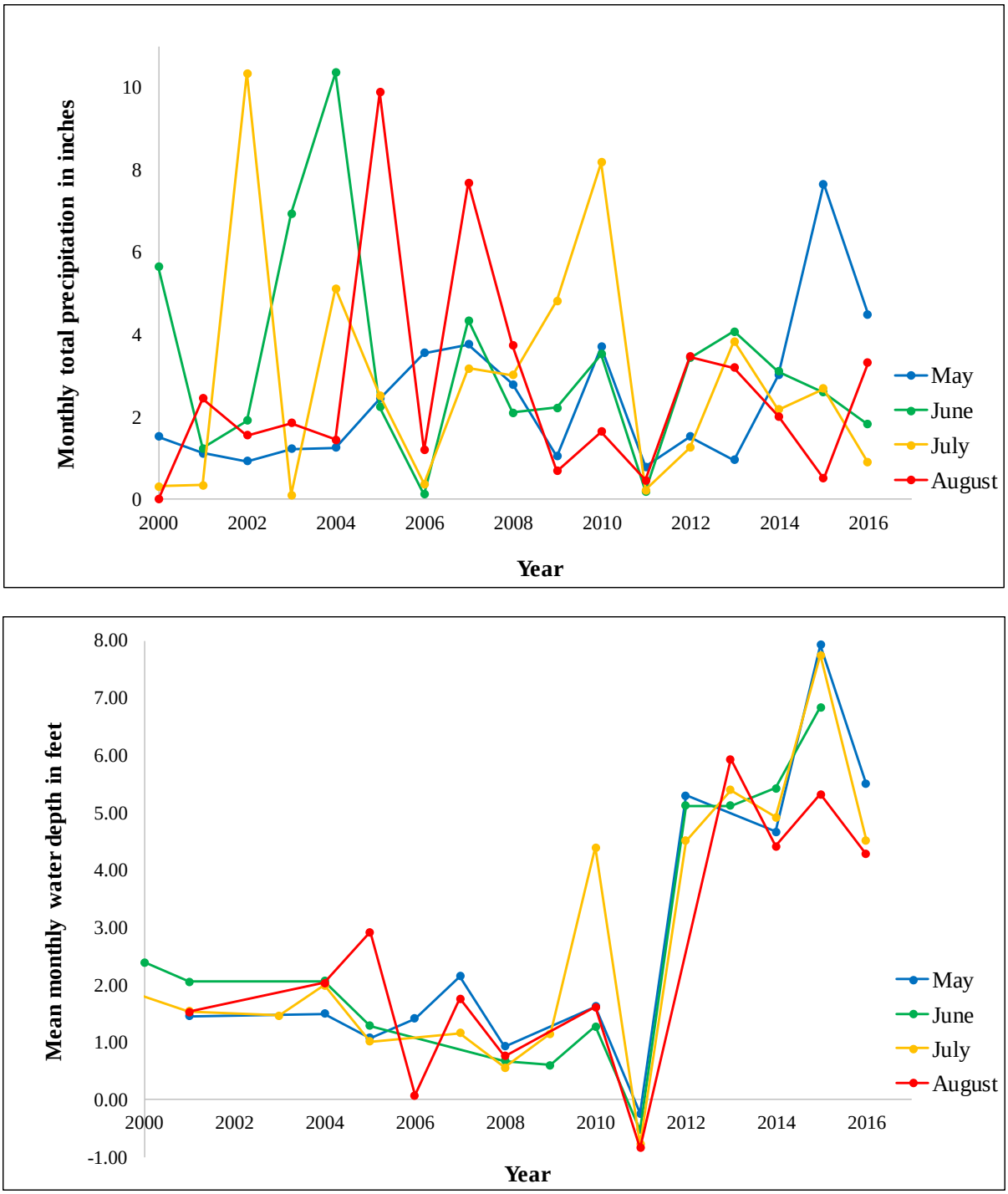

Figure 12. Graphs of monthly total precipitation (inches) in Aspermont (NOAA Station Aspermont 410394) and USGS stream gauge height (feet) at the U.S. Highway 83 bridge (USGS Station 08080500) for the months of May, June, July and August between 2000 and 2016.

Summary of Historical Information

A historical review was conducted to determine the recreational activities that have occurred on the Double Mountain Fork Brazos River since November 28, 1975. While conducting searches for recreational activities, one account of recreation was found. A fly fisherman on the Texas Fishing Forum posted a thread about dove hunting and fishing on the river (Texas Fishing Forum Double Mountain Fork Brazos River thread). The angler posted several high quality photos of the river as well as fish he had caught (sunfish and channel cats). The angler described the shallow water of the stream and a patch of quicksand. One outdoorsman in the thread mentioned that he hunted around Aspermont for several years.

Recreational use interviews revealed that the Double Mountain Fork Brazos River is currently heavily used for recreation by local residents and has been used for recreation for many years. Interviews conducted around the river and in the nearby towns of Rotan (4.8 miles away, population 1,508), Hamlin (8.6 miles away, population 2, 124), Aspermont (9 miles away, population 919) and Rule (3.6 miles away, population 636) showed that bridge crossings are important areas for recreational activities such as swimming and tubing especially after rain events and during periods of high water.

Thirty-seven interviews were collected relating to primary contact recreation on the Double Mountain Fork Brazos River. Paraphrased comments of the interviews were separated by bridge crossings and general comments (which did not relate to one specific bridge crossing) (Tables 1.1 and 1.2). Historical information in these paraphrased interview comments was examined and these comments were separated by decade for each bridge crossing and general comments. (Figure 13). A summary (sum of the number of interviews) of the number of accounts of primary contact recreation for each decade for all 37 interviews was included in Figure 13. Nineteen interviews described primary contact at the State Highway (S.H.) 70 bridge crossing compared to 3 interviews for U.S. Highway 83, 1 interview for S.H. 208 and 2 interviews for U.S. Highway 380. In addition, one interviewee (interview number 26, Table1.1) stated that tubing trips with teenagers were popular at the 83, 1835, 283 and 380 bridges. Twenty-five interviews describe primary contact in the 2010s verses 4 in the 2000s, 4 in the 1990s, 7 in the 1980s and 5 in the 1970s. These interview comments show that interviewees and their family

and friends have been swimming, tubing and wading (children) regularly for the last 40+ years on the Double Mountain Fork Brazos River.

Tables 1.1 and 1.2 and Figure 13 also reveal that the bridge crossings (Figure 6) at S.H. 70 (Figure 14) and U.S. Highway 83 (Figure 15) are important areas for current and historical primary contact recreation. Nineteen interviewees said that they carry out or have carried out primary contact activities at the S.H. 70 bridge crossing. One interviewee, during an interview, estimated that about half of the people in the town of Rotan have recreated at this location at one time or another (comment not in Table 1.1). The interviewees in interviews 3 and 10 in Table 1.1, for example, said that primary contact recreation occurred every weekend in the 1970s and 80s at the S.H. 70 bridge crossing. The interviewee in interview 6, said their children used to wade and play in the Brazos in the 1980s and 90s. The interviewee in interview 19, who has been familiar with the Brazos for the last 40 years, said he, his 7 brothers and sisters and his 10 kids have all regularly swam in the Brazos at S.H. 70 in their youth. Taken as a whole, these 19 interviews show the current and historical importance of the S.H. 70 bridge crossing to the community of Rotan.

The U.S. Highway 83 bridge crossing was also found to be an important area for primary contact recreation. This bridge crossing is a public park named Smith Park. It has two entrances (on opposite sides of U.S. 83) and 3 small pavilions each of which has a picnic table and garbage can. Smith Park has a historic marker for Rath City, which was a town founded in 1876. Rath City was established to meet the "international demand for buffalo hides" and had a trading post that, at one point in 1877, was in possession of 1,100,00 hides. In the middle of the channel of the Double Mountain Fork Brazos River adjacent to the U.S. 83 bridge there is a large concrete slab, probably the remnants of a bridge, that may serve as a platform for primary contact recreational activities. One interviewee, who is a prominent community leader in Stonewall County, said he saw 200 people swimming in the river at this location last year. He said, in an average year, about 50 people swim here. The interviewee in interview 21, who has been familiar with the river for 50 years, said he used to swim here 40 days per year in the 1970s and 80s.

Table 1.1. Interviews collected around the Double Mountain Fork Brazos River high lighting primary contact recreation activities at the bridge crossings of State Highway 70 and U.S. Highway 83. Paraphrased comments of interviewees are displayed.

Paraphrased primary contact recreation comments of interviewees. Years familiar is in parentheses.
State Highway 70 bridge primary contact recreation comments
1. The interviewee's (fam. 60 yrs.) grandkids wade and play 5 days/yr. Fishing is common after rain events.
2. Two women, under the S.H. 70 bridge, tube 2 days/yr. and swim/wade (children) 25 days/yr. Swimming occurs frequently.
3. Interviewee (fam. 60 yrs.) swims 25 days/yr. For 40 yrs., swimming has been very common. People recreate every weekend.
4. Young mother and 3 children (fam. 6 yrs.) swim and wade nearly every weekend (20 days/yr.) especially during high water.
5. Interviewee's (fam. 40 yrs.) children would wade 5 days/yr. at the S.H. 70 bridge. He has heard of tubing in the Brazos.
6. Interviewee's (fam. 40 yrs.) children use to wade and play 5 days/yr. in the Brazos in the 1980s and 90s at the S.H.70 bridge.
7. The interviewee (fam. 50 yrs.) has heard of tubing 1 day/yr. at the S.H. 70 bridge in the summer.
8. The interviewee (fam. 56 yrs.) has heard of tubing during high water at the S.H. 70 bridge.
9. The interviewee swims 10 days/yr. at the S.H. 70 bridge. Has heard of tubing there. Recreation has been popular for 30 yrs.
10. The interviewee (fam. 60 yrs.) said adults and children used to wade, play and swim every weekend from the 1950s to 80s.
11. The interviewee (fam. 50 yrs.) grew up swimming, tubing and going to keg parties on the Brazos in the 1970s to 80s.
12. The interviewee (fam. 15 yrs.) used to go to the bridge a few times a week or more to swim, hike and hang out with friends.
13. The interviewee (fam. 45 yrs.) grew up swimming on the Brazos. His 3 grandchildren and teenage daughter swim 11 days/yr.
14. The interviewee (fam. 8 yrs.) swims with 5 friends about 4 days/yr. at the S.H. 70 bridge during high water.
15. The interviewee (fam. 13 yrs.) swam 3 times 12 years ago in the summer at the S.H. 70 bridge. Has heard of swimming there.
16. A family of 5 (fam. 10 yrs.) swim, fish, picnic and hike at the S.H. 70 bridge 10 days/yr. mostly during high water.
17. The interviewee (fam. 10 yrs.) swims 32 days/yr. in the summer around the S.H. 70 bridge.
18. The interviewee's (fam. 10 yrs.) 11 yr. old grandson swims 2 days/yr. at the S.H. 70 bridge. Has witnessed swimming there.
19 The interviewee's (fam. 40 yrs.) 7 siblings used to swim once a week while growing up. His 10 kids also swam until 2006.
U.S. Highway 83 bridge primary contact recreation comments
20. The interviewee (fam. 80 years) has heard of tubing after rain events and when there is enough water.
21. The interviewee (fam. 50 years) swam 40 days/yr. in the 1970s and 80s in the spring, summer and fall.
22. Interviewee said he saw 200 people swimming at the U.S. 83 bridge last year. On average, 50 people swim there each year.

Table 1.2. Interviews collected around the Double Mountain Fork Brazos River highlighting primary contact recreation activities at the bridge crossings of State Highway 208 and U.S. Highway 380 and along the river. Paraphrased comments of interviewees are displayed.

Paraphrased primary contact recreation comments of interviewees. Years familiar is in parentheses.
State Highway 208 bridge primary contact recreation comments
23. The interviewee (fam. 25 yrs.) swims in the summer 1 day/yr. at the S.H. 208 bridge.
U.S. Highway 380 bridge primary contact recreation comments
24. Interviewee (fam. 30 yrs.) swims 20 days/yr. in the spring and summer. Said 7 children swam in the stream 3 days ago.
25. Interviewee has swum in it for 64 years. Witnesses tubing 6 times/yr. and swimming/wading children (10 ind./day) 32 times/yr.
General primary contact recreation comments
26. Interviewee (fam. 25 yrs.) tubes 1 day/yr. Said tubing trips were popular with teenagers at the 83, 1835, 283 and 380 bridges.
27. The interviewee's (fam. 65 yrs.) grandchildren wade 10 days/yr. Has heard of tubing 2 days/yr. between highway bridges.
28. The interviewee (fam. 10 yrs.) has heard of tubing between highway bridges during the spring and summer.
29. The interviewee's (fam. 60 yrs.) 4 grandchildren (ages 6 to 16 yrs. old) currently swim and wade with friends 10 days/yr.
30. The interviewee (fam. 50 yrs.) built a picnic area on the Brazos. His children swim and wade 30 days/yr. and tube 1 day/yr.
31. The interviewee's family (fam. 10 yrs.) swims 3 days/yr. in the summer. They also kayak and camp on the Brazos.
32. The interviewee swam in it as a child (fam. 26 yrs.). Children wade and tube 10 days/yr. near the S.H. 70 and 283 bridges.
33. The interviewee (fam. 22 yrs.) has heard of tubing and swimming during high water.
34. The interviewee (fam. 37 yrs.) swims 20 days/yr. in the Brazos during the summer. The interviewee has witnessed swimming.
35. The interviewee (a ranch manager)(fam. 40 yrs.) stated that they swim in the Brazos every few years.
36. The interviewee (fam. 48 yrs.) tubed down the river one time in 1985. Salt cedars are a major problem on the Brazos.
37. The interviewee said 35-40 people (ages 5 to 30 yrs. old) swim around bridges every weekend during the summer.

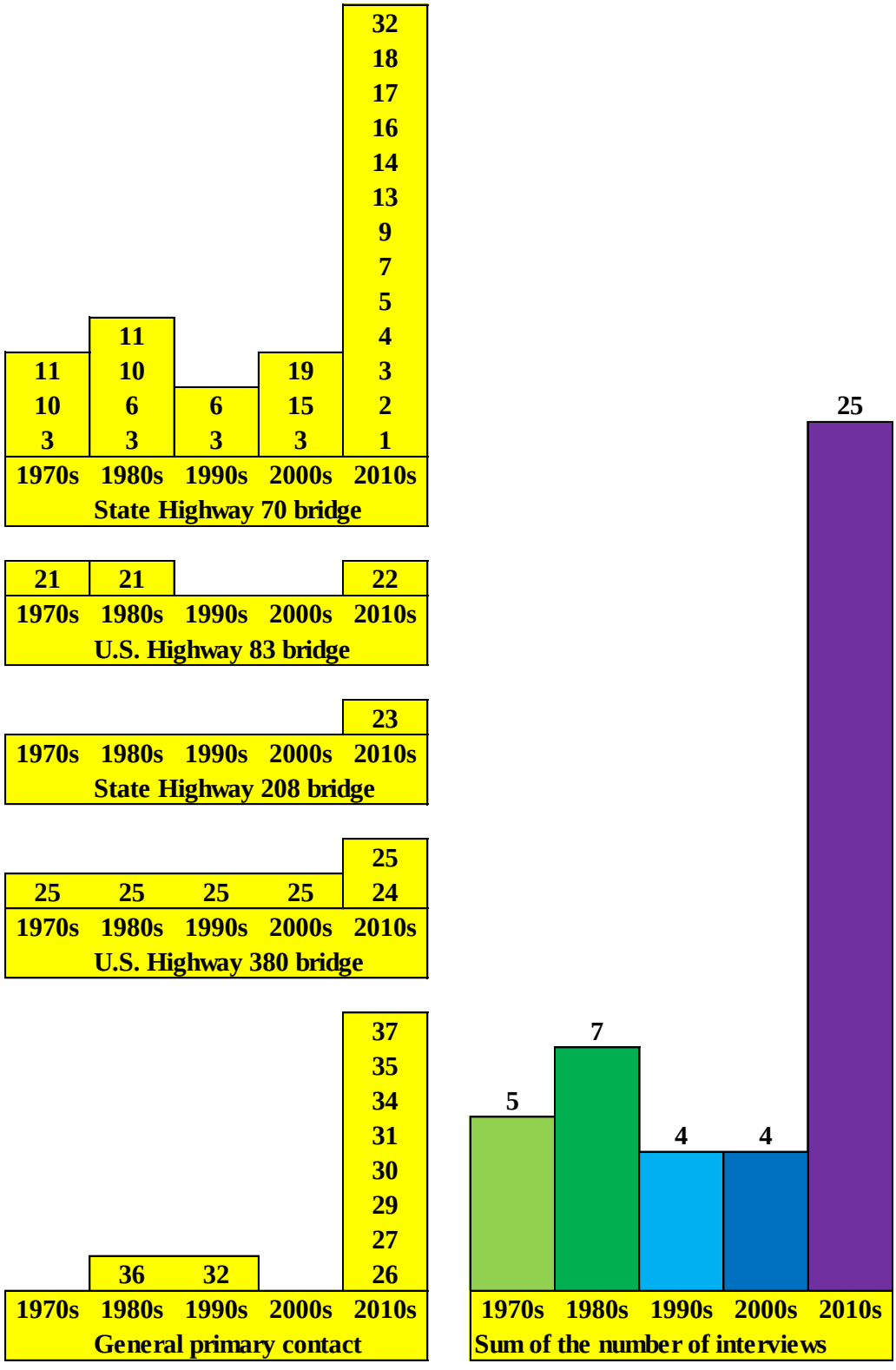

Figure 13. Primary contact interview paraphrased comments from Table 1.1 and 1.2 separated by decade for each bridge crossing and general comments. The sum of the number of paraphrased comments for each decade for all 37 interviews is displayed.

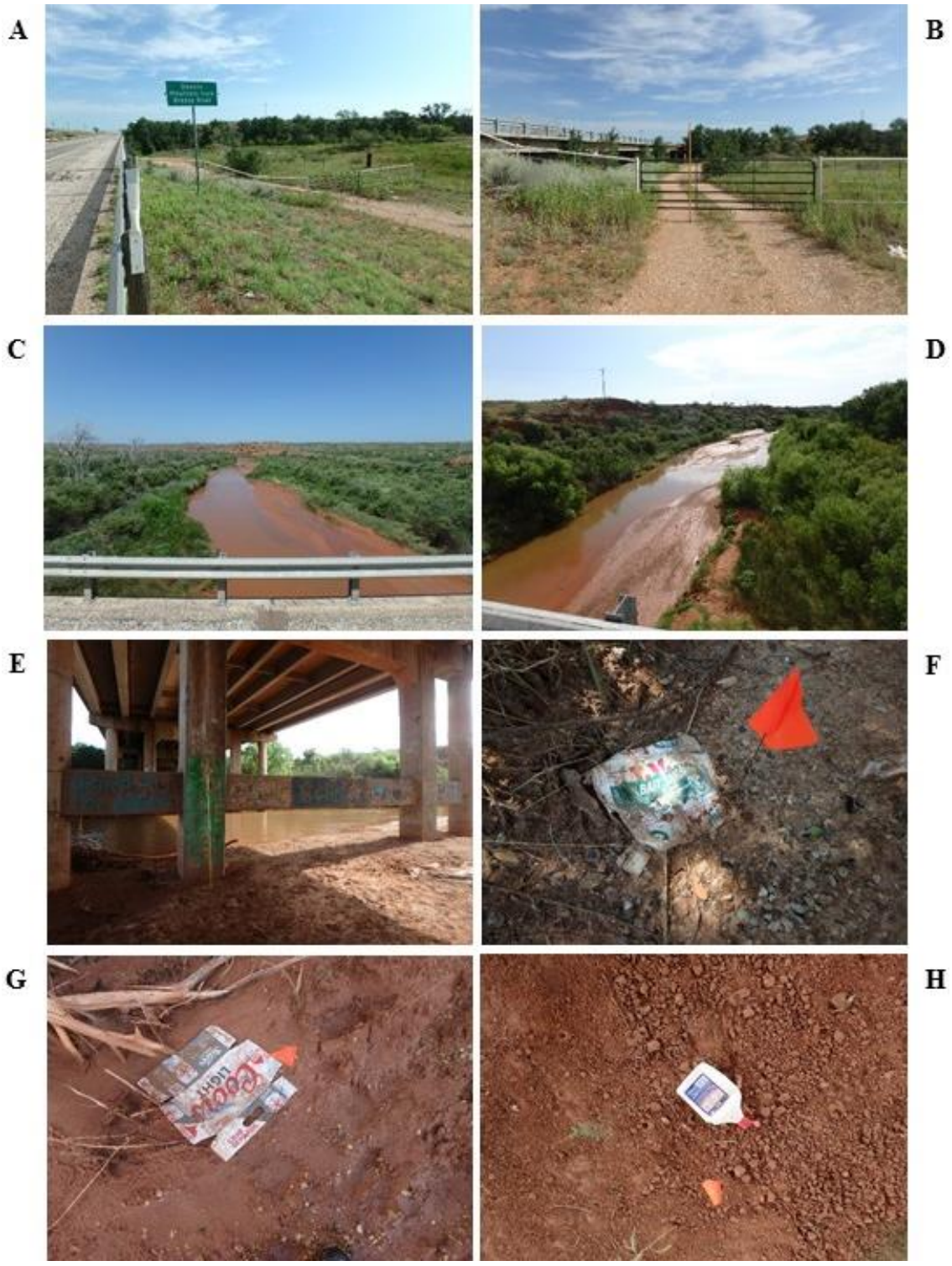

Figure 14. Photographs of an important area for primary contact recreation at the State Highway 70 bridge crossing. A-B) An access road with an unlocked gate that leads to the river. C) An upstream photo of the river. D) A downstream photo of the river. E) Graffiti under the bridge. F) An empty package of T.V. bait shrimp. G) A Coors light 12 pack box. H) Lighter fluid.

Figure 15. Photographs of an important area for primary contact recreation at the U.S. Highway 83 bridge crossing. A) An aerial photo of Smith Park and the bridge crossing. B) Two pavilions with picnic tables. C) A historical marker for Rath City. D) A downstream photo of the river. E) An old fire pit. F) Graffiti under the bridge. G) A dropline. H) Two empty bait containers.

Summary of the Informational Meeting

An informational meeting was conducted to present information to the public about TCEQ's RUAA Program, answer questions about the RUAA and our work on the Double Mountain Fork Brazos River and talk to local residents and stakeholders about their knowledge and use of this stream. Joe Martin and Kate Lavelle from the Water Quality Standards Group at the TCEQ and John Baker from TAMU presented Microsoft PowerPoint presentations describing TCEQ's RUAA program and the purpose of carrying out a RUAA on the Double Mountain Fork Brazos River. Two technicians from TAMU collected information from landowners and stakeholders during the informational meeting.

The Double Mountain Fork Brazos River informational meeting was held in the auditorium of the Aspermont Community Center (516 S Washington St., Aspermont, Texas 79502) on Wednesday, June 15, 2016 at 6:00 pm. To advertise for the informational meeting, public announcements were placed in the Fisher County Chronicle (on Wednesday, June 8 and 15), Hamlin Herald (on Thursday, June 9) and Aspermont Observer (on Wednesday, June 8). Two hundred and forty-seven letters describing the RUAA and advertising for the informational meeting were sent to landowners living on and around the Double Mountain Fork Brazos River. Seven people attended this meeting.

General Stream Characteristics

A shrub dominated corridor was the most frequently recorded riparian zone on the Double Mountain Fork Brazos River (89 %) (found by calculating the sum of the left bank and right bank riparian zone corridor categorical observations and dividing by the total, based on first surveys). This was followed by cliffs (10 %), forests (1 %) and steep banks (1 %).

The Double Mountain Fork Brazos River had an average thalweg of 0.30 m (in both first and second surveys) and an average width ranging from 9.95 to 8.13 m (first and second survey, respectively). Field technicians characterized the flow frequency as normal 99 % and 100 % of the time (first and second survey, respectively) and stream type as perennial 87 % and 100 % of

the time (first and second survey, respectively). The channel frequency was characterized as wadeable 100 % of the time during both first and second surveys (Table 2). The thalweg for the whole reach was never greater than 1.5 m at any site; all sites were wadeable. Based on the TCEQ Wastewater Outfall shapefile, the Double Mountain Fork Brazos River had no wastewater outfalls (Figure 7). No impoundments were found on the stream.

The RUAA summary for the Double Mountain Fork Brazos River (Appendix 4) is presented in Table 3. Primary contact, secondary contact 1, secondary contact 2 and non-contact recreation were characterized as occurring frequently on the Double Mountain Fork Brazos River. General public access for the stream was characterized as moderate. The Double Mountain Fork Brazos River was accessible at six bridges.

Table 2. Hydrological characteristics of the Double Mountain Fork Brazos River. Proportional frequencies represent the number of times a condition was recorded at the stream over the number of sites surveyed.

Survey	Mean thalweg (m)	Mean width (m)	Substantial pools	Flow category	Freq.	Stream type	Freq.	Channel category	Freq.	Palmer drought index (PDI)	Freq.
First	0.30	9.95	5	High	0.01	Intermittent w/ perennial pools	0.13	Wadeable	1	Extremely moist	0.16
				Normal	0.99	Perennial	0.87			Very moist	0.84
Second	0.30	8.13	1	Normal	1	Perennial	1	Wadeable	1	Extremely moist	0.06
										Very moist	0.94

Table 3. RUAA summary for the Double Mountain Fork Brazos River. Thalweg and number of pools are based on first surveys. In parenthesis are values obtained during second surveys.

RUAA Summary	
Stream Name	Double Mountain Fork Brazos River
Waterbody	1241
Classified	Yes
Primary Contact	Frequently
Secondary Contact Recreation 1	Frequently
Secondary Contact Recreation 2	Frequently
Non-Contact	Frequently
Average Thalweg (m)	0.30 (0.30)
Substantial pools>1m	5 (1)
General Public Access	Moderate
Palmer Drought Index	Very Moist

Observations and Evidence of Recreational Use

No primary contact recreation activities were observed on the Double Mountain Fork Brazos River during the field surveys conducted in this RUAA project. A secondary contact recreation activity was observed where one person was found on the shore with their feet touching the water at survey site 1241.82. Indications of human use (IHUs) found related to secondary contact include fishing tackle (9 survey sites, Figures 16B-D) and boating (2 survey sites, Figure 16B). Twenty-three IHUs related to non-contact activities were found, including: an ATV trail, beverage cans and bottles, bullet casings, burnt wood (Figure 16F), children's footwear, clothing, decorative lights on bank, a deer feeder, a fire pit, a fishing platform, a folding chair (Figure 16E), foot paths/prints (Figure 16A), graffiti, hunted turtles (Figure 16H), hunting blinds, an old lawn chair, roads, shooting targets, shotgun shells (Figure 16G), a tent tie down, tire ruts and a trail camera (Table 4). Footpaths indicate recreational use at several survey sites. For instance, at survey site 1241.65, a path with signs of use leads from Smith Park to the stream. At site 1241.77, technicians found barefoot prints of an adult and child on the bank less than 1 meter from the water's edge. At site 1241.12, there were sandals near the river and footprints along the river banks. Survey sites under bridges also showed various indications of human use. For

instance, at site 1241.76, a trot line was found attached to the bridge. There is also a road at the southeast corner of the bridge leading to stream. Under the bridge and in the immediate area there were numerous footprints, some quite small that seemed to belong to children. At survey site 1241.73, fishing line with a weight, a bobber and a minnow bucket were all found near the FM 1835 bridge. At survey site 1241.82, indications of human use included a fishing bobber, foot prints, a pistol shell casing and shotgun shells; in addition, multiple roads lead under the bridge. The survey site 1241.42 showed multiple indications of human use, mostly around the S.H. 70 bridge.

Table 4. Indications of Human Use (IHUs) recorded during field surveys on the Double Mountain Fork Brazos River. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for the whole stream. In parenthesis are the sites where these indications were recorded.

Indications of human use (IHUs) found at each survey site	Total
IHUs related to secondary contact activities	
Fishing tackle (1241.65, 1241.10, 1241.42, 1241.72, 1241.73, 1241.79, 1241.80A, 1241.82)	9
Boating (1241.10, 1241.56)	2
IHUs related to non-contact activities	
ATV/Tire tracks/trail (1241.23, 1241.82)	2
Beverage bottles/cans/cups (1241.46)	1
Bullet casing(s) (1241.42, 1241.82)	2
Children's footwear/clothing (1241.12, 1241.76, 1241.43)	3
Decorative lights on the bank (1241.88)	1
Deer feeder (1241.26)	1
Fire pit/burnt wood (1241.73, 1241.82, 1241.65)	3
Fishing platform (1241.77)	1
Folding/old lawn chair (1241.87, 1241.72)	2
Foot paths/prints (1241.12, 1241.42, 1241.77, 1241.82)	5
Graffiti (1241.65, 1241.42, 1241.73, 1241.76, 1241.82)	6
Hunted turtles (1241.82)	1
Hunting blind (1241.30, 1241.78, 1241.79)	3
Shooting target(s) (1241.42)	1
Shotgun shell(s) (1241.44, 1241.66, 1241.76, 1241.82)	5
Tent tie down (1241.26)	1

Figure 16. Photographs of indications of human use found on the Double Mountain Fork Brazos River. A) Multiple footprints next to the water. B) A boat filled with 2 cast nets and a dip net. C) A drop line. D) A fishing bait bucket. E) A chair on the bank. F) Evidence of a camp fire. G) Shotgun shells. H) Dead hunted aquatic turtles.

Surrounding Conditions on the Double Mountain Fork Brazos River

One hundred and eighty-five surrounding conditions that promote recreation were recorded during surveys on the Double Mountain Fork Brazos River (Table 5). Scenic natural surroundings (67, Figures 17A and 17B) were recorded as the most frequent surrounding condition that promotes recreation followed by rural area (63, Figure 17A) and wildlife and wildlife evidence (42, Figures 17G and 17H). The presence of bridge crossings (7, Figure 17C) and paved and unpaved roads improve access to the stream (4, Figure 17D). Other surrounding conditions that promote recreation include sandy banks (1) and a bird colony (1).

Two hundred and eighteen surrounding conditions that impede recreation were recorded during surveys on the river (Table 6). Private property (61) was recorded as the most frequent surrounding condition that impedes access followed by no public access (58), no roads (4, Figure 18A) and fences (3, Figures 18B and 18C). Other surrounding conditions that impede access were dangerous wildlife, including feral hogs (Figures 18G, 19F and 19G), snakes, coyotes, and bob cats (41), steep banks (1), garbage (6) and industrial structures related to oil extraction (2). At one survey site (1241.63), petroleum extraction activities were located within 100 meters of the river and in another site (1241.67) multiple pipes crossed the river segment.

During field surveys, technicians reported signs of cattle using the river at many survey sites (28, Figures 18F, 19C, 19D and 19E). Other conditions that impede recreation related to water quality were stagnant water (6, Figure 19H), poor water quality (6) and shallow water (2).

One hundred and eighty-five records of sustained aquatic habitat were recorded during field surveys on the Double Mountain Fork Brazos River (Table 7). Wetland plants (64, Figure 20A and 20B) were recorded as the most frequent indications of sustained aquatic habitat followed by fish (58, Figure 20C) and frogs (35, Figure 20F). Aquatic turtle(s)/carcass/burrow (9, Figure 20D), mussel shell(s) (7, Figure 20G), aquatic animal burrow(s) (4, Figure 20H), worm/snail trails (4), aquatic insects (2), aquatic snakes (2, Figure 20E), aquatic plants (1), dragonfly (1), heron tracks (1) and raccoon tracks/trails (1) were also recorded. Large game fish such as catfish, carp and gar were recorded at various survey sites (1241.1, 1241.28, 1241.63, 1241.72, 1241.77, 1241.85, 1241.86).

Table 5. Surrounding conditions (SC) that promote recreation recorded during field surveys on the Double Mountain Fork Brazos River. The presence/absence of each SC was recorded at each survey site during the first survey. Values represent the sum of these records.

Surrounding conditions that promote recreation		**Total**
General conditions that promote recreation		
Bird colony		1
Natural surroundings/corridor		67
Rural area		63
Sandy banks		1
Wildlife and wildlife evidence		42
	Subtotal	**174**
Surrounding conditions that promote access		
Bridge crossing		7
Roads (paved/unpaved)		4
	Subtotal	**11**
	Total	**185**

Figure 17. Factors that promote recreation on the Double Mountain Fork Brazos River. A-B) Natural and scenic riparian corridor and stream. C) Bridge access. D) Road crossing. E) Smith Park located on the stream at a bridge. F) A hunting blind. G) A deer in the stream. H) A gar in the stream.

Table 6. Surrounding conditions (SC) that impede recreation recorded during field surveys on the Double Mountain Fork Brazos River. The presence/absence of each SC was recorded at each survey site during the first survey. Values represent the sum of these records.

Surrounding conditions that impede recreation		Total
Surrounding conditions that impede access		
Dangerous wildlife (snakes, hogs, coyote and bob cat)		41
Garbage		6
Industrial		2
Steep banks		1
	Subtotal	**50**
Surrounding conditions related to private property		
No public access		58
Fences		3
No roads		4
Private Property		61
	Subtotal	**126**
Water characteristics that impede recreation		
Cattle or evidence of cattle		28
Poor water quality		6
Shallow water		2
Stagnant water		6
	Subtotal	**42**
	Total	**218**

Figure 18. Factors that impede recreation on the Double Mountain Fork Brazos River. A) Parts of the river are remote and difficult to access. B-C) Fences crossing the stream reducing accessibility. D) Steep banks. E) Thick vegetation on the banks. F) Cow manure in the stream. G) Feral pigs in the stream. H) An industrial pipeline crossing the stream.

Figure 19. Photographs relating to water quality on the Double Mountain Fork Brazos River. A) A stretch of the stream with clear water. B) Clay colored stream water. C) Two cows in the stream. D) Footprints of cattle accessing the stream. E) Cow manure in the stream. F) Six feral pigs in the stream. G) Feral pig tracks next to the stream. H) A small isolated pool with a film on the water's surface.

Table 7. Sustained aquatic habitat recorded during field surveys on the Double Mountain Fork Brazos River. The presence/absence of sustained aquatic habitat was recorded at each survey site during the first survey. Values represent the sum of these records.

Sustained aquatic habitat	Total
Aquatic animal burrow(s)	4
Aquatic insects	2
Aquatic plants	1
Aquatic snakes	2
Aquatic turtle(s)/carcass/burrow	9
Mussel shell(s)	7
Dragonfly	1
Fish	58
Frogs	35
Heron tracks	1
Raccoon tracks/trails	1
Wetland plants	64
Worm/snail trails	4
Total	**185**

Figure 20. Photographs of sustained aquatic habitat recorded during field surveys on the Double Mountain Fork Brazos River. A-B) Wetland vegetation on the banks of the stream. C) A gar. D) An aquatic turtle in the stream. E) A snake going into the stream. F) A frog near the water. G) A mussel shell. H) Crawfish burrows.

Double Mountain Fork Brazos River Recreational Use Interviews

Fifty-six recreational use interviews were conducted in the Double Mountain Fork Brazos River area to determine how the river is being used for recreation. Most of the interviews were conducted in person (87.5 %), while 12.5 % of the interviews were conducted over the phone. The majority of the interviewees were selected because they live in the area (45 %), live in Rotan (16 %), live near the river (13 %), the river flows through or borders their property (11 %), work in the area (5 %), live next to the river (4 %), were recreating (fishing) on the river (4 %), are a landowner close to the river (2 %) or manager of property containing the river (2 %) (Figure 21).

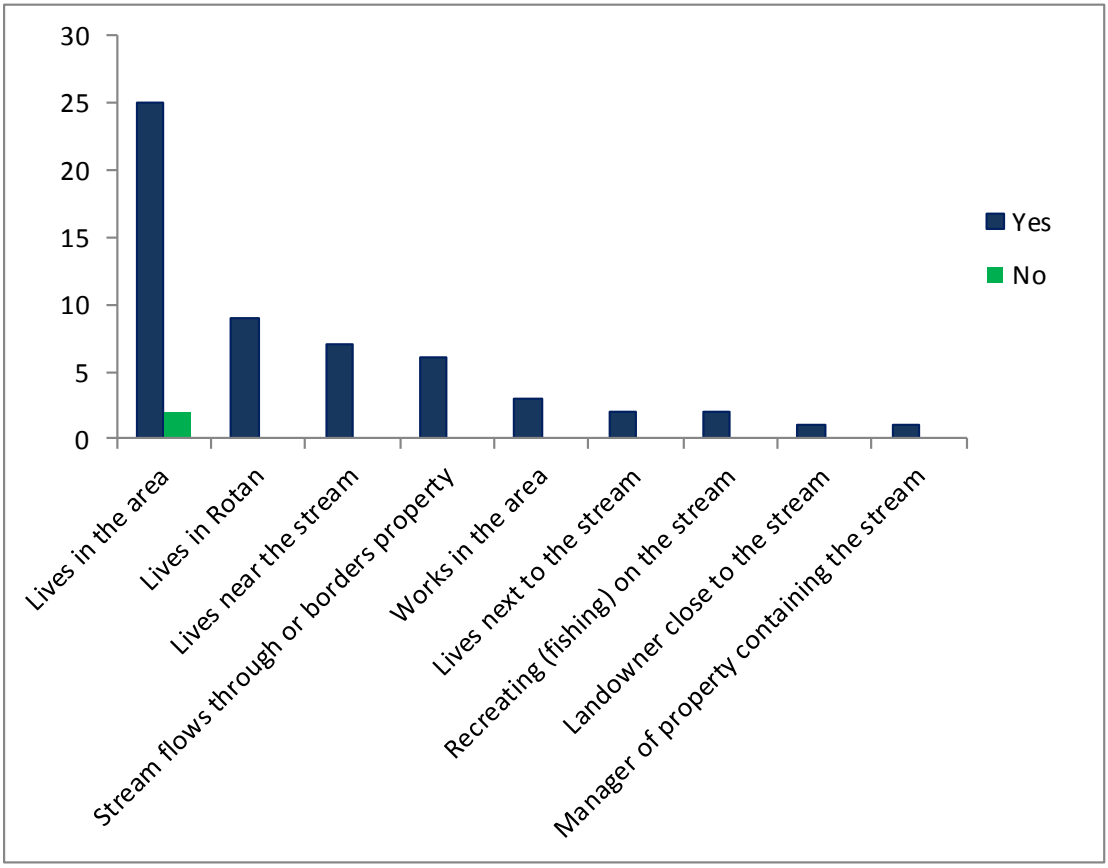

Figure 21. Number of interviewees that participated in interviews assessing recreation on the Double Mountain Fork Brazos River. Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body for 20 to 50 years (35 %) or over 50 years (35 %) (Table 8). Eighty-seven percent of the 52 interviewees that

were willing to respond have been familiar with the river for 10 or more years. Most interviewees classified the river as being intermittent with perennial pools (56 %) while others classified the river as perennial (29 %) or intermittent (10 %) (Table 9).

Table 8. Number of years interviewees have been familiar with the Double Mountain Fork Brazos River.

No. of years familiar	Percentage of interviews
≤5	0
6-<10	4
10-<20	17
20-<50	35
≥50	35
Not applicable	4
Did not specify, No data	6

Table 9. River classification by interviewees who are familiar with portions of the Double Mountain Fork Brazos River.

Classification	Percentage of interviews
Intermittent with perennial pools	56
Perennial	29
Intermittent	10
Not applicable	6

Over half of the people that participated in the interviews and their families use the Double Mountain Fork Brazos River for recreation (63 %). Among the 35 interviewees that use the river for recreation, 86 % engage in primary contact recreational activities, while 14 % engage in secondary contact recreational activities. Primary contact recreational activities include swimming (25 interviews), wading children (11 interviews) and tubing (6 interviews) (Table 10). Secondary contact recreation activities include wading adults (5 interviews), fishing, boating and

kayaking. Non-contact activities include ATV riding, camping, hiking, hunting, partying, picnicking, playing on the shores or banks and shooting guns.

Table 10. Recreational activities reported on Double Mountain Fork Brazos River that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	25
Wading - Children	11
Tubing	6
Secondary contact recreational activities	
Wading - Adults	5
Fishing	14
Boating	1
Kayaking	3
Noncontact recreational activities	
ATV riding	5
Camping	1
Hiking	2
Hunting	3
Partying	2
Picnicking	4
Playing on shore or banks	1
Shooting guns	1
No recreational activities	
Do not use	17

Based on 32 interviews in which data was obtained on the number of days per year recreation occurs in Brazos River, 94 % of the interviewees and their families recreate on the Double Mountain Fork Brazos River between 1 to 30 days per year (mean ± standard deviation = 9.3 ± 8.2 days/year) and 9 % use the river over 30 to 100 days. On average, interviewees and their

families who carry out primary contact activities use the river 13.4 ± 12.6 days per year (Based on 30 interviews). Recreation on the Double Mountain Fork Brazos River occurs in all seasons.

Most of the 17 interviewees that do not use the river for recreation mentioned that the Double Mountain Fork Brazos River has little or no water (47 %) (Table 11). Other reasons given for not using the river were related to other personal interests (35 %), poor access (18 %), either too little or dangerously fast water (6 %), interview does not own property on stream (6 %), and old age (6 %).

Table 11. Reasons stated by interviewees for not using the Double Mountain Fork Brazos River. Note that a single interviewee can report one or more reasons for not using the river for recreation.

Reasons for not using the Brazos River	**Percentage of total responses**
Physical characteristics (Little or no water)	47
Other personal interests	41
Physical characteristics (Poor access)	18
River has either too little water or dangerously fast water	6
Does not own property on stream	6
Did not specify	12

Interviewees have witnessed a variety of recreational activities currently occurring on the Double Mountain Fork Brazos River (Table 12). These activities included primary contact recreation (12 reports of swimming, 4 reports of tubing and 2 reports of wading children) and secondary contact recreation including fishing, kayaking and wading adults. Fishing was the most frequently witnessed activity. Non-contact recreational activities included hunting. Forty-four percent of interviewees have not witnessed recreation on the Double Mountain Fork Brazos River.

Table 12. Recreational activities witnessed by interviewees on the Double Mountain Fork Brazos River. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed recreational activities	Number of reports
Primary contact recreational activities	
Swimming	12
Tubing	4
Wading - Children	2
Secondary contact recreational activities	
Fishing	22
Kayaking	1
Wading - Adults	1

Interviewees also reported hearing of a variety of recreational activities occurring on the Double Mountain Fork Brazos River (Table 13). These activities included primary contact recreation (2 reports of swimming, 12 reports of tubing and 1 report of wading children) and secondary contact recreation including fishing, kayaking, wading adults, boating and canoeing. Tubing was the most frequent recreational activity that people have heard of occurring on the river. Noncontact recreational activities heard of include ATV riding and hunting. Fifty-seven percent of interviewees have not heard of recreation occurring on the Double Mountain Fork Brazos River.

Table 13. Recreational activities that interviewees have heard of occurring on the Double Mountain Fork Brazos River. Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the river	Number of reports
Primary contact recreational activities	
Swimming	2
Tubing	12
Wading - Children	1
Secondary contact recreational activities	
Fishing	5
Kayaking	1
Wading - Adults	1
Boating	1
Canoeing	1
Noncontact recreational activities	
ATV riding	2
Hunting	2

Sabana River Results

The Sabana River (1222C) (Figures 22-26) is a 74.6-mile-long unclassified stream segment that flows from the upstream portion of the stream northwest of Rising Star in Eastland County to the confluence of Proctor Lake northeast of Comanche County. Recreation and physical characteristics of the Sabana River were characterized with 41 field surveys (Figures 27) and 92 recreational use interviews.

Figure 22. Photograph of the Sabana River (Water body 1222C) at RUAA survey site 1222C.3 on August 7, 2016.

Figure 23. Photograph of the Sabana River (Water body 1222C) at RUAA survey site 1222C.12 on August 6, 2016.

Figure 24. Photograph of the Sabana River (Water body 1222C) at RUAA survey site 1222C.20 on August 6, 2016.

Figure 25. Photograph of the Sabana River (Water body 1222C) at RUAA survey site 1222C.35 on August 6, 2016.

Figure 26. Photograph of the Sabana River (Water body 1222C) at RUAA survey site 1222C.44 on August 6, 2016.

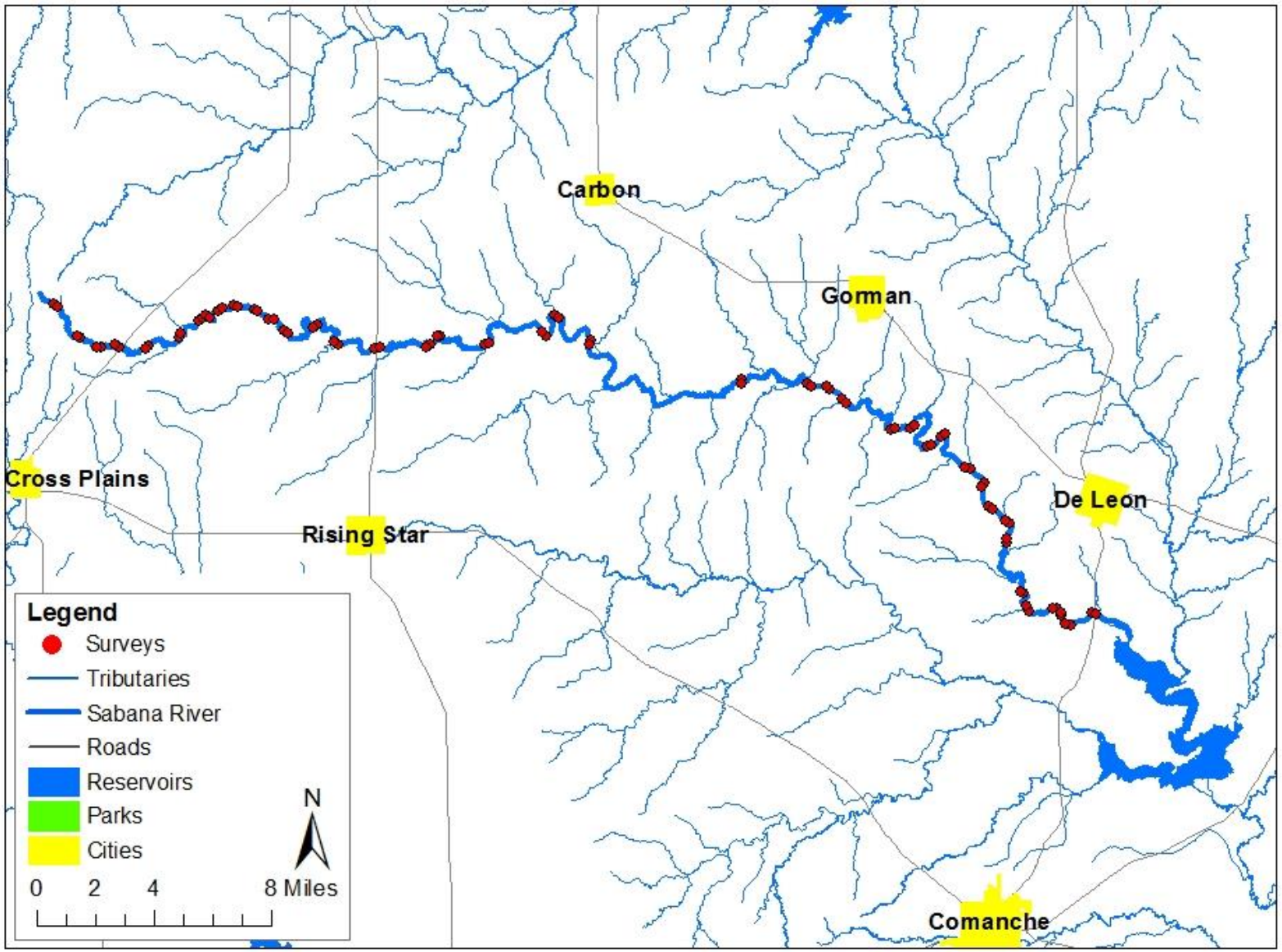

Figure 27. Map of the Sabana River with completed survey sites, tributary streams, reservoirs, parks, cities and major roads.

Summary of the Informational Meeting

An informational meeting was conducted to present information to the public about the RUAA on the Sabana River and talk to local residents and stakeholders about their knowledge and use of this stream. Joe Martin and Kate Lavelle from the Water Quality Standards Group at the TCEQ and John Baker from TAMU presented Microsoft PowerPoint presentations describing TCEQ's RUAA program and the purpose of carrying out a RUAA on the Sabana River. Two technicians from TAMU collected information from landowners and stakeholders during the informational meeting.

The Sabana River informational meeting was held in the auditorium of De Leon City Hall (125 S Texas St., De Leon, Texas 76444) on Tuesday, June 14, 2016 at 6:00 pm. To advertise for the informational meeting, a public announcement was placed in the Eastland County Today newspaper on Thursday, June 9. One hundred and eighty-eight letters describing the RUAA and advertising for the informational meeting were sent to landowners living on and around the Sabana River. Three people attended this meeting.

General Stream Characteristics

Forest was the most frequently recorded riparian zone on the Sabana River (71 %) (found by calculating the sum of the left bank and right bank riparian zone corridor categorical observations and dividing by the total). This was followed by steep banks (12 %), a shrub dominated corridor (7 %), pastures (5 %) and denuded/eroded banks (5 %).

The Sabana River had an average thalweg of 0.48 m and an average width of 5.49 m. Field technicians characterized the flow frequency as no flow 34 %, as high 29 % and as normal 22 % of the time. Stream type was characterized as ephemeral 39 %, intermittent 10 %, intermittent with perennial pools 34 % and perennial 17 % of the time. The channel frequency was characterized as wadeable 88 % of the time and as non-wadeable 12 % of the time (Table 14). The thalweg for the whole reach was greater than 1.5 m at one survey site (1222C.43A). Based

on the TCEQ Wastewater Outfall shapefile, the Sabana River had no wastewater outfalls (Figure 28). One impoundment was found on the stream near the beginning of the segment.

The RUAA summary for the Sabana River (Appendix 4) is presented in Table 15. Primary contact, secondary contact 1, secondary contact 2 and non-contact recreation were characterized as occurring frequently on the Sabana River. General public access for the Sabana River was characterized as moderate. The Sabana River was accessible at twenty-six bridges.

Table 14. Hydrological characteristics of the Sabana River. Proportional frequencies represent the number of times a condition was recorded at the stream over the number of sites surveyed.

Mean thalweg (m)	Mean width (m)	Substantial pools	Flow category	Freq.	Stream type	Freq.	Channel category	Freq.	Palmer drought index (PDI)	Freq.
0.48	5.49	30	Dry	0.10	Ephemeral	0.39	Wadeable	0.88	Extremely moist	1
			High	0.29	Intermittent	0.10	Non-wadeable	0.12		
			Low	0.05	Intermittent w/ perennial pools	0.34				
			No flow	0.34	Perennial	0.17				
			Normal	0.22						

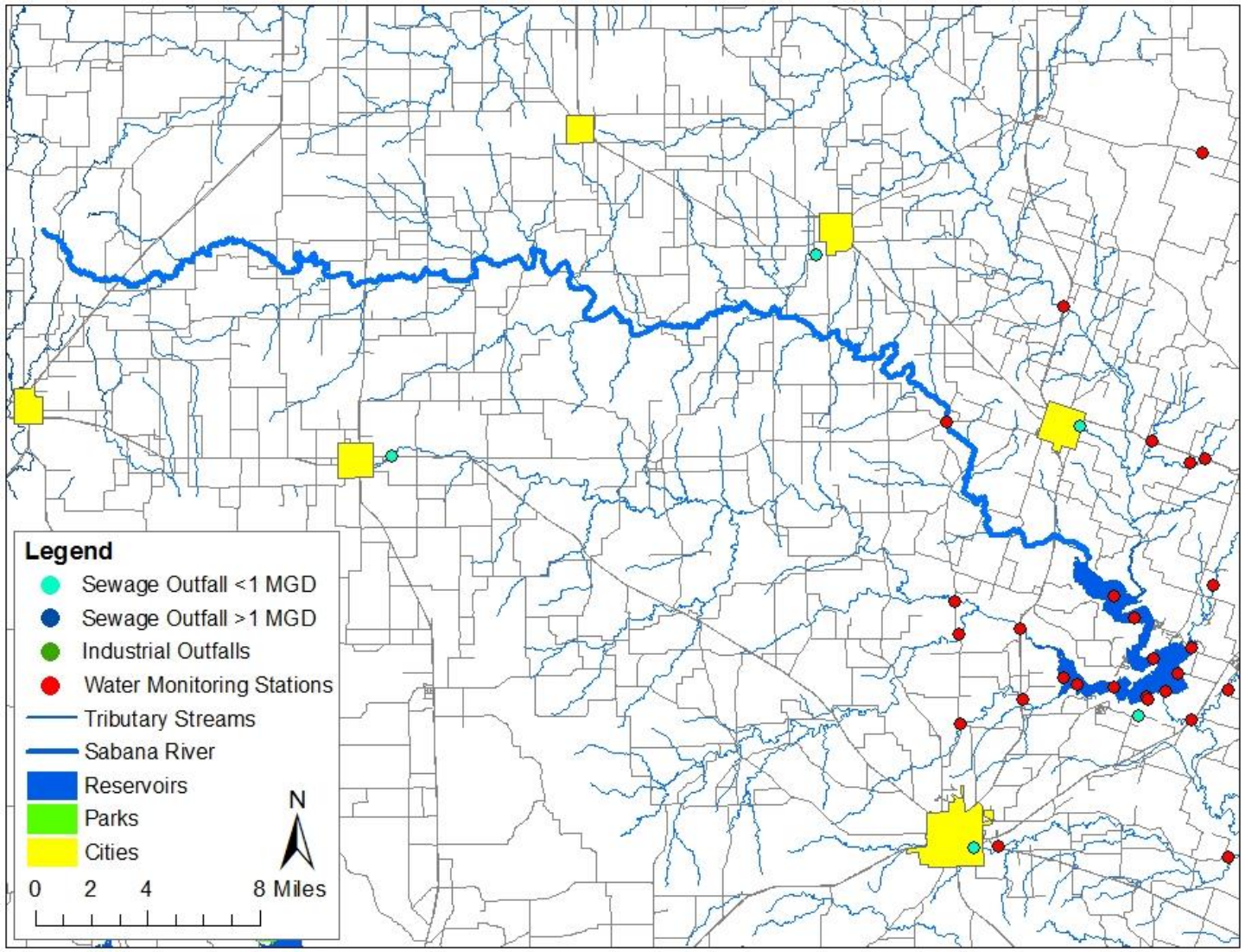

Figure 28. Map of the Sabana River with wastewater outfalls, TCEQ water quality monitoring stations, tributary streams, reservoirs, parks, cities and major roads.

Table 15. RUAA summary for the Sabana River.

RUAA Summary	
Stream Name	Sabana River
Waterbody	1222C
Classified	No
Primary Contact	Frequently
Secondary Contact Recreation 1	Frequently
Secondary Contact Recreation 2	Frequently
Non-Contact	Frequently
Average Thalweg (m)	0.48
Substantial pools>1m	30
General Public Access	Moderate
Palmer Drought Index	Extremely Moist

Observations and Evidence of Recreational Use

No primary or secondary contact recreational activities were observed on the Sabana River during the field surveys conducted in this RUAA project. IHUs related to secondary contact recreation (fishing tackle) were found at 3 survey sites (Table 16, Figure 29E and 29F). Fourteen IHUs related to non-contact activities were found, including: ATV trails, bicycle tracks, bullet casings, a chair and a radio (Figure 29A), children's toys, deer feeders and stands, fireworks, foot paths/prints (Figure 29C), graffiti, a picnic table (Figure 29B), roads, shooting targets, shotgun shells (Figure 29G), and toilet paper. Signs of hunting and recreation involving firearms were observed at seven sites. For instance, at site 1222C.20A, a picnic table, a plastic jug that had been used for a shooting target and a deer feeder were all observed near the stream. At site 1222C.10A, a deer feeder was located close to the stream at the end of a private dirt road. Lastly, at site 1222C.17, a deer feeder was about 50 meters from the river.

Table 16. Indications of Human Use (IHUs) recorded during field surveys on the Sabana River. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for the whole stream.

Indications of human use (IHUs) found at each survey site	Total
IHUs related to secondary contact activities	
Fishing tackle (1222C.30, 1222C.41, 1222C.43)	3
IHUs related to non-contact activities	
ATV tracks/trail (1222C.11, 1222C.37)	2
Bicycle tracks (1222C.37)	1
Bullet casing (s) (1222C.13)	1
Chair and radio (1222C.32)	1
Children's toys (1222C.41)	1
Deer feeders and/or stands (1222C.10A, 1222C.17, 1222C.20A, 1222C.20A, 1222C.43B)	5
Fireworks (1222C.41, 1222C.43)	2
Foot paths/prints (1222C.30, 1222C.33, 1222C.35, 1222C.38A)	4
Graffiti (1222C.43)	1
Picnic table (1222C.20A)	1
Road(s) (1222C.10A, 1222C.20A)	2
Shooting target(s) (1222C.20A)	1
Shotgun shell(s) (1222C.38B, 1222C.39)	2
Toilet paper (1222C.11)	1

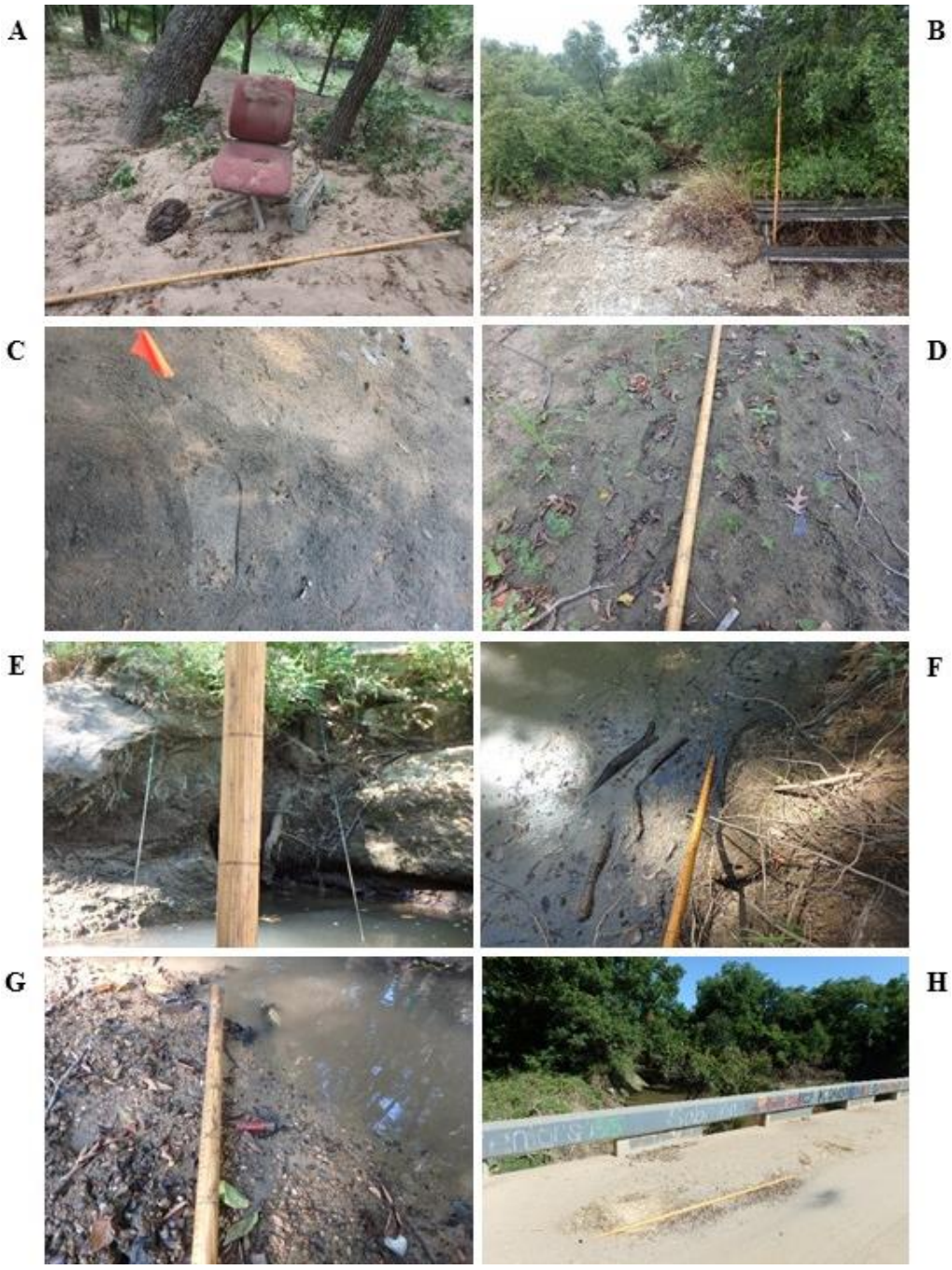

Figure 29. Photographs of indications of human use found on the Sabana River. A) A sandy chair and a two speaker radio/cassette portable sound system next to the stream. B) A picnic table next to the stream. C-D) Foot prints next to the stream. E) A drop line. F) A cast net in the mud. G) A shotgun shell. H) Bridge access.

Surrounding Conditions on the Sabana River

Ninety-two surrounding conditions that promote recreation were recorded on the Sabana River (Table 17). Scenic natural surroundings (28, Figures 30A and 30B) were recorded as the most frequent surrounding condition that promotes recreation followed by rural area (27) and wildlife and wildlife evidence (23, Figures 30E-H). Bridge crossings (8, Figure 30C), paved and unpaved roads (2, Figure 30D), trails/paths (1) and ATV trails (1) improve access to the river.

One hundred and forty-six surrounding conditions that impede recreation were recorded during surveys on the river (Table 18). Private property (21) was recorded as the most frequent surrounding condition that impedes access followed by no public access (15), no roads (5), fences (3, Figure 31B), and no trespass sign (1, Figure 31A). Other surrounding conditions that impede access were steep slopes (16, Figure 31G), dangerous wildlife including feral hogs and snakes (16, Figure 31D and 31F), garbage (14, Figure 31E), industrial pipelines (6), no flow at time of survey (6, Figures 31B and 32C), no water at time of survey (6, Figure 31C and 32B) and shallow water (1).

Other conditions that impede recreation related to water quality were poor water quality (22, Figure 32D and 32E); a film covering the water surface and unpleasant odor were recorded at multiple sites. During field surveys, technicians reported signs of cattle using the river (14, Figure 32F and 32G). Other animals including feral pigs were also reported using the Sabana River (Figure 32H)

One hundred and three records of sustained aquatic habitat were recorded during field surveys on the Sabana River (Table 19). Frogs (30, Figure 33D) were recorded as the most frequent indications of sustained aquatic habitat followed by fish (28, Figure 33C), mussel shell(s) (10, Figure 33G) and wetland plants (10, Figure 33A). Aquatic plants (8, Figure 33B), algae (4), aquatic animal burrow(s) (3), aquatic insects (2), aquatic snakes (2, Figure 33E), raccoon tracks/trails (2), aquatic turtle(s)/carcass/burrow (1), beaver evidence (1, Figure 33F), crayfish burrow(s)/carapace(s) (1, Figure 33H) and heron tracks (1) were also recorded.

Table 17. Surrounding conditions (SC) that promote recreation recorded during field surveys on the Sabana River. The presence/absence of each SC was recorded at each survey site. Values represent the sum of these records.

Surrounding conditions that promote recreation		Total
General conditions that promote recreation		
Natural surroundings/corridor		28
Rural area		27
Substantial Pool		1
Deer feeder		1
Wildlife and wildlife evidence		23
	Subtotal	**80**
Surrounding conditions that promote access		
ATV trail		1
Bridge crossing		8
Roads (paved/unpaved)		2
Trails/paths		1
	Subtotal	**12**
	Total	**92**

Figure 30. Factors that promote recreation on the Sabana River. A-B) Natural and scenic riparian corridor and stream. C) Bridge access. D) A road crossing. E) A fish in the stream. F) Wildlife (A raccoon skull). G) Wildlife (A frog next to the water). H) Wildlife (An animal burrow).

Table 18. Surrounding conditions (SC) that impede recreation recorded during field surveys on the Sabana River. The presence/absence of each SC was recorded at each survey site. Values represent the sum of these records.

Surrounding conditions that impede recreation		Total
Surrounding conditions that impede access		
Dangerous wildlife (snakes and hogs)		16
Garbage		14
Industrial		6
No flow at time of survey		6
No water at time of survey		6
Shallow water		1
Steep slopes		16
	Subtotal	**65**
Surrounding conditions related to private property		
No public access		15
Fences		3
No roads		5
No trespass sign		1
Private property		21
	Subtotal	**45**
Water characteristics that impede recreation		
Cattle or evidence of cattle		14
Poor water quality		22
	Subtotal	**36**
	Total	**146**

Figure 31. Factors that impede recreation on the Sabana River. A) A no trespassing sign. B) A fence crossing the stream reducing accessibility. C) No water in parts of the stream. D) Evidence of rooting by feral pigs. E) Garbage in the water. F) Dangerous wildlife (A copperhead snake). G) A steep bank preventing access to one side of the stream. H) A log jam that is reducing accessibility.

Figure 32. Photographs relating to water quality on the Sabana River. A) A photo of the stream that characterizes some parts of the Sabana River. B) A dry stream bed at survey site 1222C.7. C) A small isolated pool with green water. D-E) Green algae growing on the surface of the water at survey sites 1222C.44 and 1222C.21, respectively. F) Cow manure next to the stream. G) A cow trail leading down to the stream. H) An area next to the stream with a large number of animal tracks.

Table 19. Sustained aquatic habitat recorded during field surveys on the Sabana River. The presence/absence of sustained aquatic habitat was recorded at each survey site. Values represent the sum of these records.

Sustained aquatic habitat	Total
Algae	4
Aquatic animal burrow(s)	3
Aquatic insects	2
Aquatic plants	8
Aquatic snakes	2
Aquatic turtle(s)/carcass/burrow	1
Beaver evidence	1
Mussel shell(s)	10
Crayfish burrow(s)/carapace(s)	1
Fish	28
Frogs	30
Heron tracks	1
Raccoon tracks/trails	2
Wetland plants	10
Total	**103**

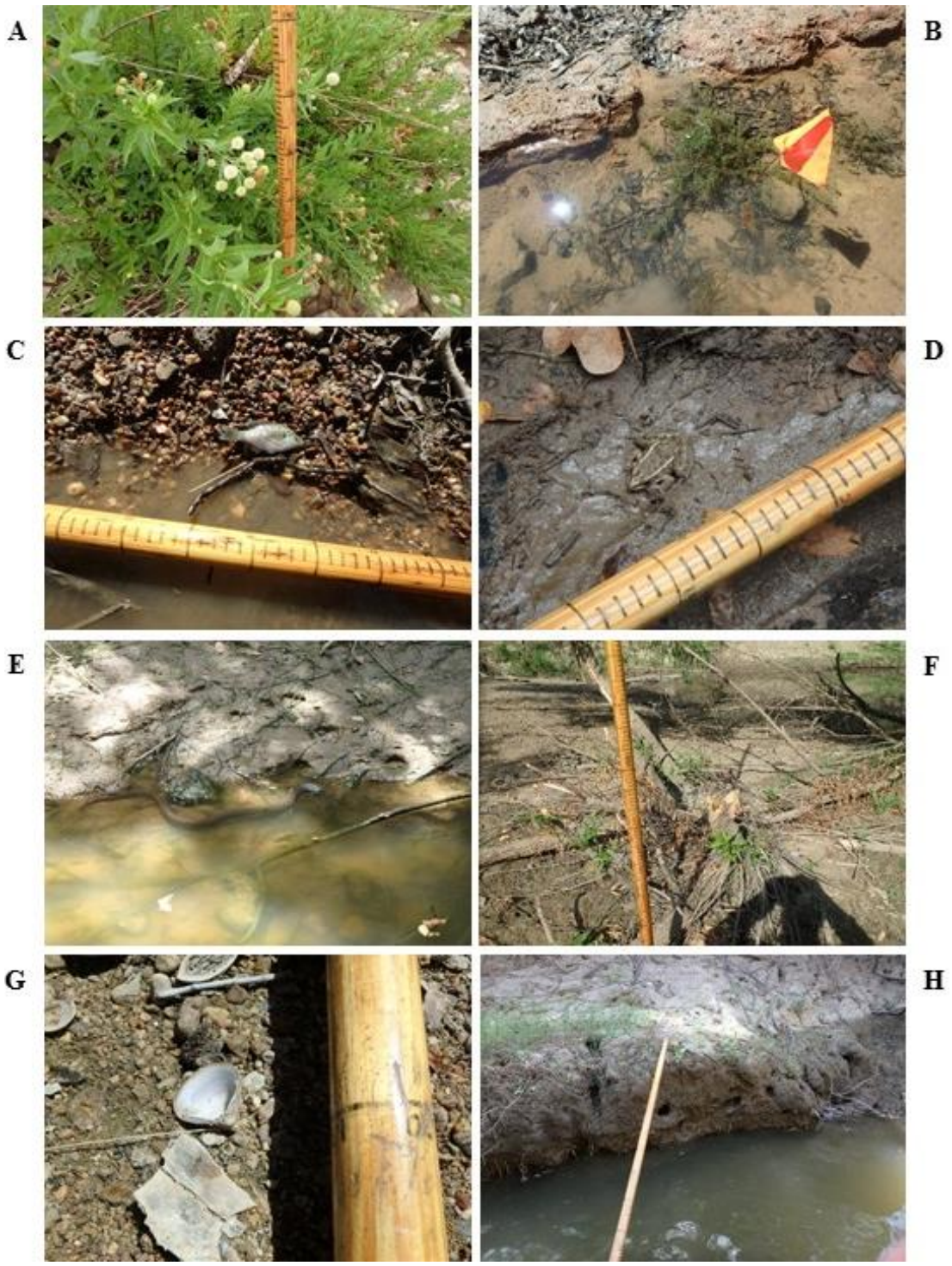

Figure 33. Photographs of sustained aquatic habitat recorded during field surveys on the Sabana River. A) Wetland vegetation (Cephalanthus occidentalis) on the stream bank. B) Aquatic vegetation in the stream. C) A fish. D) A frog next to the water. E) A water snake in the stream. F) Evidence of beavers. G) A mussel shell. H) Crawfish burrows.

Sabana River Recreational Use Interviews

Ninety-two recreational use interviews were conducted in the Sabana River area to determine how the river is being used for recreation. Most of the interviews were conducted in person (86 %), while 10 % of the interviews were conducted over the phone and 4 % by e-mail. The majority of the interviewees were selected because they live in the area (41 %). Other interviewees were selected because the landowner was in the area (23 %), river flows through or borders property (16 %), landowner was close to the river (13 %), they live next to the river (5 %), or they were fishing in a local stream that connects to the Sabana River 0.5 miles away (1 %) (Figure 34).

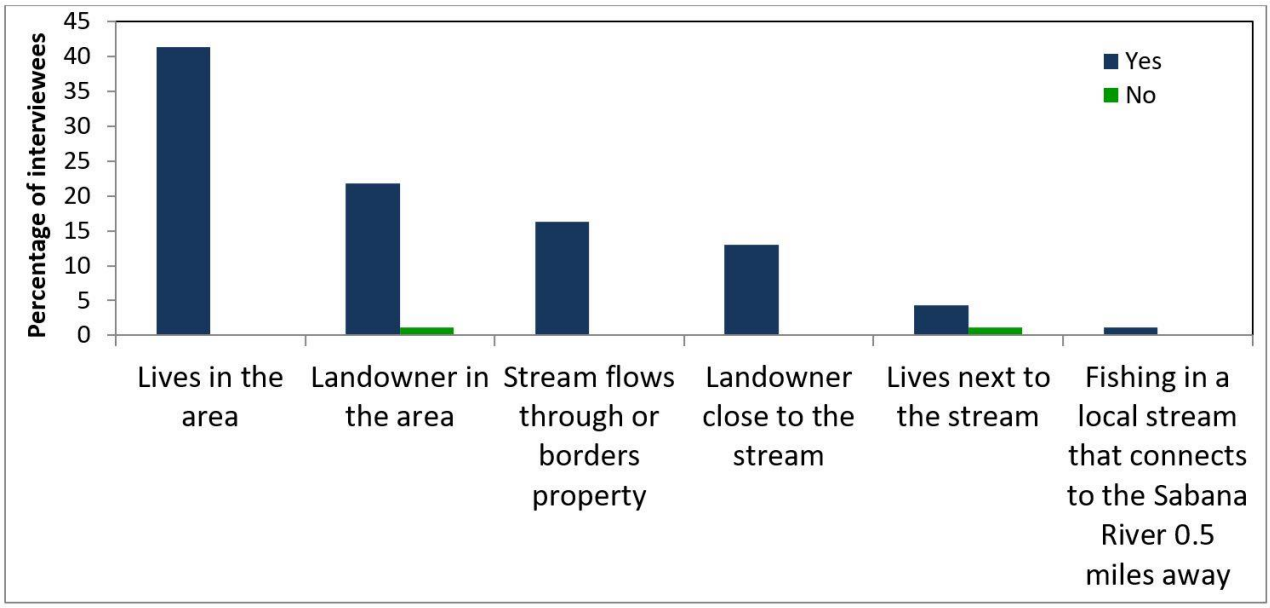

Figure 34. Number of interviewees that participated in interviews assessing recreation on the Sabana River. Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body from 20 to 50 years (34 %) (Table 20). Sixty-six percent of the 90 interviewees that were willing to respond have been familiar with the river for 10 years or more. Most interviewees classified the river as being intermittent with perennial pools (38 %) while others classified Sabana River as intermittent (22 %), ephemeral (21 %) or perennial (8 %) (Table 21).

Table 20. Number of years interviewees have been familiar with the Sabana River.

No. of years familiar	Percentage of interviews
≤5	8
6-<10	7
10-<20	7
20-<50	34
≥50	24
Not applicable	10
Did not specify, No data	10

Table 21. River classification by interviewees who are familiar with portions of the Sabana River.

Classification	Percentage of interviews
Intermittent with perennial pools	38
Intermittent	22
Ephemeral	21
Perennial	8
Described as a dry creek in an email	1
Did not specify	1
Not applicable	9

Nearly half of the people that participated in the interviews and their families use the Sabana River for recreation (42 %). Among the 38 interviewees that use the river for recreation, 47 % engage in primary contact recreational activities. Primary contact recreational activities include swimming (7 interviews), tubing (3 interviews) and wading children (7 interviews) (Table 22). Secondary contact recreational activities include wading adults (1 interview), fishing, boating and canoeing. Non-contact recreation activities include ATV riding, camping, hunting, picnicking, playing on the shore or bank, use for scenic views and wildlife and nature watching.

Based on 31 interviews in which data was obtained on the number of days per year recreation occurs on the Sabana River, 87 % of the interviewees and their families recreate on the Sabana River between 1 to 30 days per year (mean ± standard deviation = 7.7 ± 8 days/year), 19 % use the river between 50 and 300 days per year, and 3 % use the river almost daily (note that the

same interviewee can report using the river between 1-30 days for certain activities and between 50-300 days for others). On average, interviewees and their families who carry out primary contact activities use the river 9.4 ± 10.4 days per year (based on 5 interviews). Recreation on the Sabana River occurs in all seasons.

Table 22. Recreational activities reported on the Sabana River that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	7
Tubing	3
Wading - Children	7
Secondary contact recreational activities	
Wading - Adults	1
Boating	1
Canoeing	2
Fishing	25
Noncontact recreational activities	
ATV riding	2
Camping	1
Hunting	18
Picnicking	2
Playing on shore or banks	1
Use only for scenic views	1
Walking	2
Watching wildlife or nature	1
No recreational activities	
Do not use	52

Most of the 52 interviewees that do not use the river for recreation mention that the Sabana River has little or no water (33 %) (Table 23). Other reasons given for not using the river were related

to better recreational options (10 %), other personal interests (8 %), poor water quality (4 %) and poor access (4 %).

Table 23. Reasons stated by interviewees for not using the Sabana River. Note that a single interviewee can report one or more reasons for not using the river for recreation.

Reasons for not using the Sabana River	**Percentage of total responses**
Physical characteristics (Little or no water)	33
Better recreational options	10
Other personal interests	8
Physical characteristics (Poor water quality)	4
Physical characteristics (Poor access)	4

Interviewees have witnessed a variety of recreational activities currently occurring on the Sabana River (Table 24). These activities include primary contact recreation (5 reports of swimming, 3 reports of wading children and 1 report of a Baptism) and secondary contact recreation including fishing, kayaking, boating and wading adults. Fishing was the most frequently witnessed activity. Noncontact recreational activities witnessed included hunting and illegally shooting fish. Sixty-one percent of interviewees have not witnessed recreation in the Sabana River.

Table 24. Recreational activities witnessed by interviewees on the Sabana River. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed recreational activities	Number of reports
Primary contact recreational activities	
Swimming	5
Wading - Children	3
Baptism	1
Secondary contact recreational activities	
Fishing	27
Kayaking	1
Boating	2
Wading - Adults	2
Noncontact recreational activities	
Hunting	3
Illegally shooting fish	1

Interviewees also reported hearing of a variety of recreational activities occurring on the Sabana River (Table 25). These activities include primary contact recreation (3 reports of swimming and 1 report of wading children) and secondary contact recreation including fishing and canoeing. Noncontact recreational activities heard of include ATV riding and hunting. Fishing was the most frequent recreational activity that people have heard of occurring in the river. Sixty-six percent of interviewees have not heard of recreation occurring in the Sabana River.

Table 25. Recreational activities that interviewees have heard of occurring on the Sabana River. Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the river	Number of reports
Primary contact recreational activities	
Swimming	3
Wading - Children	1
Secondary contact recreational activities	
Fishing	18
Canoeing	1
Noncontact recreational activities	
ATV riding	1
Hunting	8

Acknowledgements

Many people contributed to the success of these Recreational Use Attainability Analyses including scientists at the TCEQ and TAMU.

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U.S. Department of Agriculture's National Agriculture Statistics Service. 2012. Census of Agriculture, County Profile (for Kent, Stonewall and Haskell Counties). Volume 1. Geographic Areas Series. Part 51. AC-12-A-51.

U.S. Geological Survey, 20141010, NLCD 2011 Land Cover (2011 Edition, amended 2014)-National Geospatial Data Asset (NGDA) Land Use Land Cover: None None, U.S. Geological Survey, Sioux Falls, SD.

Appendices

Appendix 1

Contact Information Form
(This form must be completed prior to conducting a RUAA survey.)

River or stream name: _____

Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. Document whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project.

Required Local Contacts:

TCEQ region staff	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Clean Rivers Partners (River Authority and other local partners)	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Texas Parks and Wildlife Department Point of Contact: Cindy Hobson 512.389.8195 cindy.hobson@tpwd.texas.gov	Notified: ☐ Yes ☐ No Date: _____
Texas State Soil Water Conservation Board Point of Contact: T.J. Helton 254.773.2250 ext. 234 thelton@tsswcb.texas.gov	Notified: ☐ Yes ☐ No Date: _____

Suggested Additional Local Contacts to Notify (*Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. If contacted, include whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project on a separate page and attach it to this form*):

Local Parks and Recreation Departments	Yes ☐ No☐
Local Government/Jurisdiction	Yes ☐ No☐
Local Recreation Groups	Yes ☐ No☐
Conservation Groups	Yes ☐ No☐
Local County Extension Agent	Yes ☐ No☐
Watershed Groups	Yes ☐ No☐
Long-term Landowners/Adjacent Landowners	Yes ☐ No☐
Texas Stream Team	Yes ☐ No☐
Canoe Clubs	Yes ☐ No☐
City Commissioners Office	Yes ☐ No☐
Real estate agents	Yes ☐ No☐
Local non-profits	Yes ☐ No☐
City/county offices (Engineer, Health, Law Enforcement)	Yes ☐ No☐
Flood control districts	Yes ☐ No☐
Councils of Government	Yes ☐ No☐
TPWD Game Warden	Yes ☐ No☐
Other:_____	Yes ☐ No☐

Contact Information Form from TCEQ's 2014 Recreational UAA Procedures.

Appendix 2

Field Data Sheets –RUAA Survey

(complete for each site)

Site:

Data Collectors & Contact Information:
Date & Time: County Name:
Stream Name:
Segment No. or nearest downstream Segment No.:
Description of Site:

A. Stream Characteristics:

1. Check the following channel flow status that applies.

☐ dry ☐ no flow ☐ low ☐ normal ☐ high ☐ flooded

2. Check the following stream type that applies on the day of the survey:

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event, and contains no refuge pools capable of sustaining a viable community of aquatic organisms.

☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a seven-day, two-year low-flow (7Q2) flow of less than 0.1 cubic feet per second is considered intermittent.

☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second.

☐ Perennial: A stream which flows continuously throughout the year. Perennial streams have a 7Q2 equal to or greater than 0.1 cubic feet per second.

☐ Designated or unclassified tidal stream: A stream that is tidally influenced. If you checked this box, you will need to contact the TCEQ Water Quality Standards Group and evaluate whether or not a bathing beach is located along the tidal stream and whether or not a bathing beach is located along the estuary, bay or Gulf water that the tidal stream flows into.

3. Riparian Zone (Mark dominant categories with L (Left Bank) and R (Right Bank). Bank orientation is determined by the investigator facing downstream.)

_____ Forest	_____Urban	_____ Rip rap
_____ Shrub dominated corridor	_____ Pasture	_____ Concrete
_____ Herbaceous marsh	_____ Row crops	Other (specify): _____
_____ Mowed/maintained corridor	_____ Denuded/Eroded bank	

4. Ease of bank access to the water body: ☐ Easy ☐Moderately easy ☐Moderately difficult ☐Difficult

5. Please describe access opportunities or explain why the site is not easily accessible (Attach photos for documentation):

_____

_____

_____

_____

6. Dominant Primary Substrate

☐Cobble ☐Sand ☐Silt ☐Mud/Clay ☐Gravel ☐Bedrock ☐Rip rap ☐ Concrete

Field Data Sheet (Page 1 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

B. Primary Contact Water Recreation Evaluation:

- Primary contact recreation definition: Activities that are presumed to involve a significant risk of ingestion of water (e.g. wading by children, swimming, water skiing, diving, tubing, surfing, and the following whitewater activities: kayaking, canoeing, and rafting).

1. Were water recreation activities that involve a significant risk of ingestion (full body immersion) observed at this site?

☐ Yes ☐ No primary contact recreation activities were observed

a. Check the following boxes of primary contact recreation activities observed at the time of the sampling event at the site (Attach photos of the activities or lack of activities).

☐ Wading-Children ☐ Tubing
☐ Wading-Adults ☐ Surfing
☐ Swimming ☐ Whitewater-kayaking, canoeing, rafting
☐ Water skiing ☐ Other : _____
☐ Diving ☐ frequent public swimming-created by publicly owned land or commercial operations

b. Check the number of individuals observed at the site: ☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.

☐ Water in mouth or nose of the individual ☐ Primary touch: Individual's body (or portion) immersed in water
☐ Secondary touch: fishing, pets and related contact with water ☐ Individual is in a boat touching water
☐ Individual is on shore near water within 8 meters (25ft) of water ☐ Individual is well away from water between 8 and 30 meters (100 ft) ☐ Not applicable

2. If primary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of primary contact (depth, etc.) (Attach photos, etc. for documentation).

_____
_____

3. Describe if there is public access (e.g. parks, roads, etc.) (Attach photos, maps, etc. for documentation).

_____
_____

4. Is an area with primary contact recreation activities or a bathing beach (e.g. state/local parks with swimming, etc.) located near (e.g. within 5 miles upstream and downstream) this site?

_____
_____

C. Secondary Contact Water Recreation Evaluation:

- Secondary contact recreation 1: Activities that commonly occur but have limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating). These activities are presumed to pose a less significant risk of water ingestion than primary contact recreation but more than secondary contact recreation 2.
- Secondary contact recreation 2: Activities with limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating) that are presumed to pose a less significant risk of water ingestion than secondary contact recreation 1. These activities occur less frequently than secondary contact recreation 1 due to physical characteristics of the water body or limited public access.

Field Data Sheet (Page 2 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name: _____ Site: _____

Date: _____ Time: _____

1. Were water recreation activities observed at the site, but the nature of the recreation does not involve a significant risk of ingestion (e.g. secondary contact recreation activities)? ☐ Yes ☐ No secondary contact recreation activities were observed

a. Check the following boxes of secondary contact recreation activities that were observed at the time of the sampling event at the site (Attach photos of activities or lack of activities).

☐ Fishing
☐ Boating-commercial, recreational
☐ Non-whitewater-kayaking, rafting, canoeing
☐ No secondary contact recreation activities were observed
☐ Other secondary contact activities: _____

b. Check the number of individuals observed at the site.
☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.
☐ Secondary touch: fishing, pets and related contact with water ☐ In a boat touching water
☐ Body on shore near water within 8 meters (25ft) of water ☐ Body well away from water between 8 and 30 meters (100 ft)

2. If secondary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of secondary contact (Attach photos, etc. for documentation).
_____
_____

3. If secondary contact recreation activities are observed, how often do water recreational activities occur that do not involve a significant risk of water ingestion? ☐frequently ☐ infrequently
Please describe how often the activities occur? ☐ Unknown ☐ Never ☐ Daily ☐ Monthly ☐ Yearly

4. If infrequently, what is the reason? ☐ physical characteristics of the water body ☐ limited public access ☐ other
If other, list reasons: _____

5. Describe the physical characteristics of the water body that hinders the frequency of secondary contact recreation (depth, etc.) (Attach photos or depth measurements, etc. for documentation).
_____
_____
_____

6. Describe why there is limited public access (e.g. lack of roads, river or stream banks overgrown, etc.) (Attach photos, maps, etc. for documentation).
_____
_____
_____

D. Noncontact Recreation Evaluation

Noncontact recreation applies to water bodies where recreation activities do not involve a significant risk of water ingestion (e.g. activities with limited body contact incidental to shoreline activity, including birding, hiking, and biking), and where primary and secondary contact recreation uses do not occur because of unsafe conditions, such as barge traffic.

1. Provide site-specific information and documentation (including photographs) regarding unsafe conditions, recreation activities, and presence or absence of water recreation activities.
_____
_____

Field Data Sheet (Page 3 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

E. Stream Channel and Substantial Pools Measurements

Please check the following which best describes the river or stream (A non-wadeable stream is one that is too deep to wade. Dry streams are considered wadeable.): □ Wadeable □ Non-wadeable

1. Wadeable Streams

Determine whether or not the average depth at the thalweg is greater than 0.5 meters and if there are substantial pools with a depth of 1 meter or greater. Walk an approximately 300 meter reach (total) at the site and take the following measurements within the 300 meter reach. Measurements should be taken during dry weather flows (sustained or typical dry, warm-weather flows between rainfall events, excluding unusual antecedent conditions of drought or wet weather

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

a) Substantial pools - Measure the length of each pool within the 300 meter reach (if > 10 pools only measure 10 pools). Also measure the width (at the widest point) and deepest depth of each pool. A substantial pool is considered a pool greater than 10 meters in length for the purposes of a RUAA Survey. Report measurements to two significant figures. If depths are too deep to measure then report >1.5 meters.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1			
Pool 2			
Pool 3			
Pool 4			
Pool 5			
Pool 6			
Pool 7			
Pool 8			
Pool 9			
Pool 10			

b)Average depth at the thalweg –Take depth measurements every 30 meters within the 300 meter reach to calculate an average depth at the thalweg (at least 11 measurements needed). Report measurements to two significant figures. If depths are too deep at a particular transect to measure then report >1.5 meters. Use 1.5 when calculating the mean.

Distance	Depth (meters)
0 meters	
30 meters	
60 meters	
90 meters	
120 meters	
150 meters	
180 meters	
210 meters	
240 meters	
270 meters	
300 meters	
Average	

Field Data Sheet (Page 4 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

c) Stream width - Measure (1) the width at one point which represents the typical average width of the 300 meter reach; (2) the width at the narrowest point of the stream within the 300 meter reach; and (3) the width at the widest point of the stream within the 300 meter reach. Report measurements to two significant figures.

Measurement Type	Width (meters)
Typical Average Width of 300 meter reach	
Width at narrowest point of the stream within 300 meter reach	
Width at the widest point of the stream within 300 meter reach	

2. Non-wadeable Streams

If accessible, take 11 width measurements which represent typical widths of the 300 meter reach. If the water is too deep the entire 300 meter reach then record the estimated average width of the water body. Report measurements to two significant figures.

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

# Measurements	Width (meters)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Field Data Sheet (Page 5 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

F. Additional RUAA Information. ***Summarize your observations for the entire 300 meter reach.***

1. Check the following activities observed over the site reach.

☐ Drinking or water in mouth	☐ Playing on shoreline
☐ Bathing	☐ Picnicking
☐ Walking	☐ Motorcycle/ATV
☐ Jogging/running	☐ Hunting/Trapping
☐ Bicycling	☐ Wildlife watching
☐ Standing	☐ None
☐ Sitting	☐ Other: _____
☐ Lying down/sleeping	

2. Are there permanent or long-term hydrologic modifications that are constructed and operated in a way that affects the recreational uses? ☐ Yes ☐ No (If yes, please provide supporting documentation and photos.)

Comments: _____

_____

3. Check any channel obstructions that apply (Attach photos).

☐ Culverts	☐ Fences	☐ Log jams	☐ Rip rap	☐ Water control structure
☐ Barbed wire	☐ Dams	☐ Thick vegetation	☐ Low bridges	☐ None
☐ Utility pipe	☐ Other (specify):_____			

4. Check all surrounding conditions that promote recreational activities (Attach photos of evidence or unusual items of interest).

☐ Campgrounds	☐ Stairs/walkway	☐ Roads (paved/unpaved)	☐ Other:_____
☐ Playgrounds	☐ Boating access (ramps)	☐ Populated area	☐ None of the Above
☐ Rural area	☐ Beach	☐ Docks or rafts	
☐ Residential	☐ Bridge crossing	☐ Commercial outfitter	
☐ National forests	☐ Commercial boating	☐ Trails/paths (hiking/biking)	
☐ Urban/suburban location	☐ Nearby school	☐ Power Line Corridor	
☐ Golf Course	☐ Paved parking lot	☐ Parks (national/city/county/state)	
☐ Sports Field	☐ Unimproved parking lot	☐ Public Property	

Comments:_____

_____

5. Check all surrounding conditions that impede recreational activities (Attach photos of evidence or unusual items of interest).

☐ Private Property	☐ Fence
☐ No trespass sign	☐ Barge/ship traffic
☐ Wildlife	☐ Industrial
☐ Steep slopes	☐ None of the Above
☐ No public access	☐ Other:_____
☐ No roads	

Comments:_____

_____

6. Check any indications of human use (Attach photos).

☐ Roads	☐ RV/ATV Tracks	☐ NPDES Discharge	☐ Organized event
☐ Rope swings	☐ Camping Sites	☐ Gates on corridor	☐ No Human Presence
☐ Dock/platform	☐ Fire pit/ring	☐ Children's toys	
☐ Foot paths/prints	☐ Fishing Tackle	☐ Remnants of kids' play	
☐ Other: _____			

Comments_____

_____

Field Data Sheet (Page 6 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

7. Please list any additional items that may impede recreation, such as excessive aquatic vegetation or algae, excessive debris, garbage, snakes, alligators, abundant wildlife, etc.? (Attach photos).

_____
_____
_____
_____

8. Please list any evidence of sustained aquatic habitat such as clam shells, aquatic or marsh vegetation, turtle shells, etc. (Attach photos)

_____
_____
_____
_____

9. Is the site located in a wildlife preserve with large wildlife (i.e waterfowl) population? ☐ Yes ☐ No

10. Please document any other relevant information regarding recreational activities and the water body in general (for example, area outside of the stream reach evaluated).

_____
_____
_____
_____
_____

Field Data Sheet (Page 7 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Severity Value	Description
☐ 1 No Flow	When a flow severity of *1* is recorded for a sampling visit, record a flow value of 0 ft/s (using parameter code 00061) for that sampling visit. A flow severity of *1* describes situations where the stream has water visible in isolated pools. There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. "No flow" not only applies to streams with pools but also to long reaches of streams that have water from bank to bank but no detectable flow.
☐ 2 Low Flow	When streamflow is considered low, record a flow-severity value of *2* for the visit, along with the corresponding flow measurement (parameter code 00061). In streams too shallow for a flow measurement where water movement is detected, record a value of < 0.10 ft/s. ***Note:*** Use a stick or other light object to verify the direction of water movement. Make sure the movement is downstream and not the effect of wind. What is low for one stream could be high for another.
☐ 3 Normal Flow	When streamflow is considered normal, record a flow severity value of *3* for the visit, along with the corresponding flow measurement (parameter code 00061). "Normal" is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another.
☐ 4 Flood Flow	Flow-severity values for high and flood flows have long been established by the EPA and are not sequential. Flood flow is reported as a flow severity of *4*. Flood flows are those which leave the confines of the normal stream channel and move out onto the floodplain (either side of the stream).
☐ 5 High Flow	High flows are reported as a flow severity of *5*. High flow would be characterized by flows that leave the normal stream channel but stay within the stream banks.
☐ 6 Dry	When the stream is dry, record a flow-severity value of *6* for the sampling visit. In this case the flow (parameter code 00061) is not reported. This will indicate that the stream is completely dry with no visible pools.

Field Data Sheet (Page 8 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 3

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

Interviewer's Name: _____

Date & Time (include AM or PM): _____

Interviewed: ☐ In person ☐ By phone ☐ By mail ☐ By e-mail

☐ No interviews were conducted
If no interviews were conducted, please provide an explanation:
_____
_____

*Are you willing to respond to a short survey about this stream? ☐ Yes ☐ No

Interviewee selected because (e.g., resource manager, Gov. official, conservationist, property owner, local resident, standing by stream, etc.)
_____
_____

Questions:

1. Are you familiar with this stream? ☐ Yes ☐ No If yes, how many years? _____
   If yes, proceed to #2. If no, stop here and do not conduct an interview.

2. What location(s) along the stream are you familiar with:
_____
_____

3. Have the interviewer characterize the stream flow. Since the interviewer may not be familiar with TCEQ's definitions or distinction between the different water bodies, please refer to the definitions listed below when asking this question.

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event
☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. (Channel contains flowing water for only a portion of the year and surface water may be absent at times.)
☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second. (When not flowing, the water may remain in isolated pools.)
☐ Perennial: A stream which flows continuously throughout the year.

4. Have you or your family personally used the stream for recreation? ☐ Yes ☐ No
   If yes, proceed to #6. If no, proceed to #5.

5(a). List reasons stream not used. _____
_____

5(b). Proceed to #7.

Interview Form (Page 1 of 2) from TCEQ's 2014 Recreational UAA Procedures.

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

6.) a) How do you use the stream? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

7. Have you observed others using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #8. If no, proceed to #9.

8. a) What kinds of uses have you witnessed? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

9. Have you heard about anyone using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #10. If no, conclude the interview.

10. a) What kind of uses have you heard about? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

11. Can you recommend someone else we could contact that knows the stream? ☐ Yes ☐ No
If yes, list person's contact information: _____
_____

12. Additional comments (from the interviewee or interviewer):

_____
_____

Interview Form (Page 2 of 2) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 4

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: _____
Segment No. or Nearest Downstream Segment No.: _____
Classified?: _____
County: _____

1. Observations on Use
   a. Do primary contact recreation activities occur on the water body?
      frequently seldom not observed or reported unknown

   b. Do secondary contact recreation 1 activities occur on the water body?
      frequently seldom not observed or reported unknown

   c. Do secondary contact recreation 2 activities occur on the water body?
      frequently seldom not observed or reported unknown

   d. Do noncontact recreation activities occur on the water body?
      frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body
   a. What is the average thalweg depth? _____ meters

   b. Are there substantial pools deeper than 1 meter? yes no

   c. What is the general level of public access?
      easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)
   Mild-Extreme Drought Incipient dry spell Near Normal Incipient wet spell Mild-Extreme Wet

RUAA Summary Sheet (Page 1 of 1) from TCEQ's 2014 Recreational UAA Procedures.